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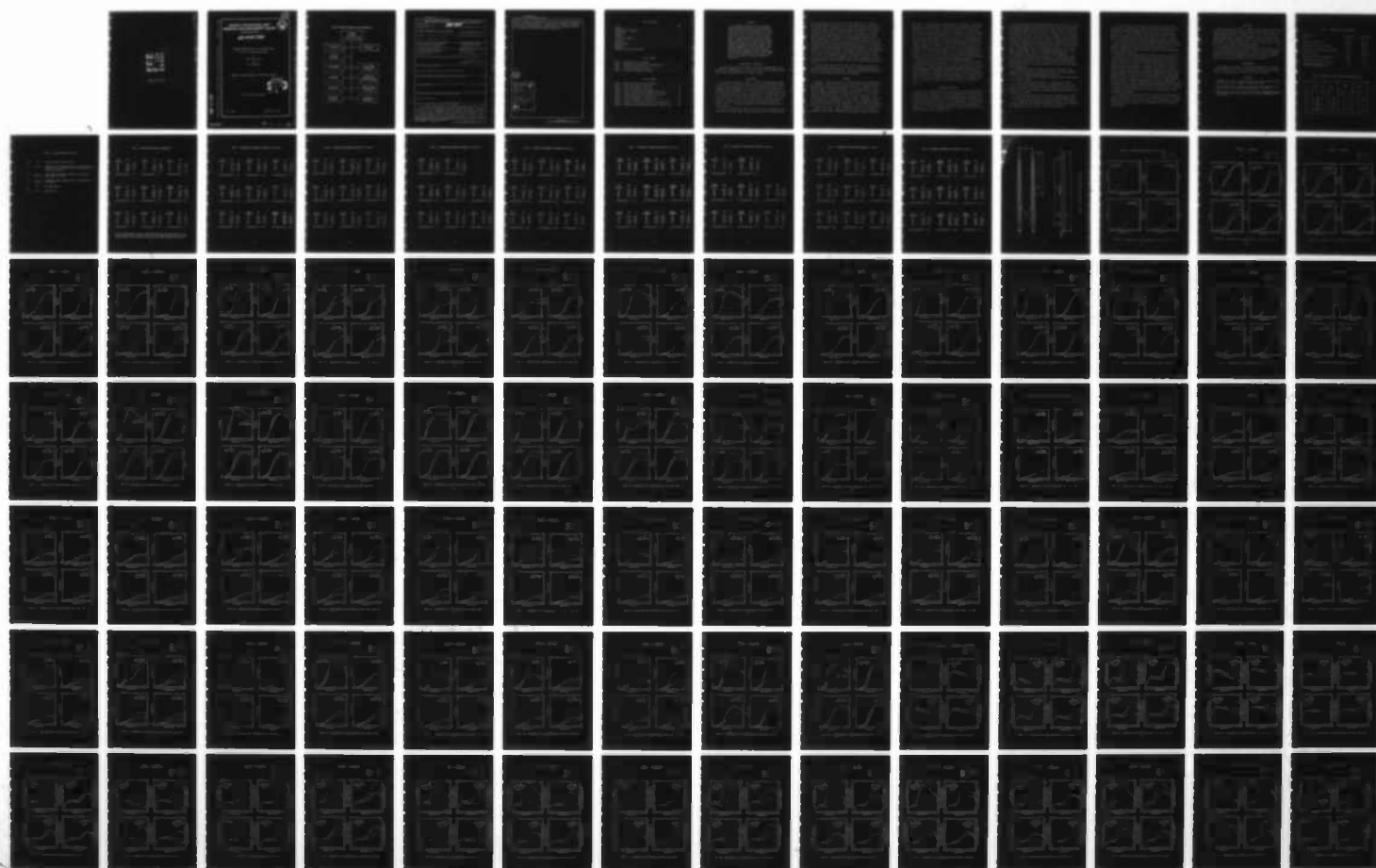
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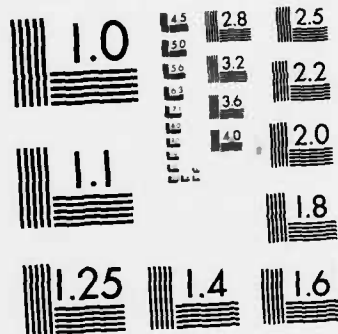
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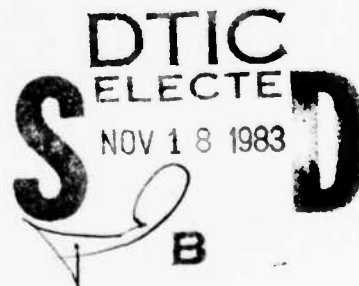


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RESPONSE CHARACTERISTICS OF A SYSTEMATIC SERIES
OF 30,000 TON SWATH CONFIGURATIONS

By
Charles R. Turner
and
K.K. McCreight

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Ship Performance Department

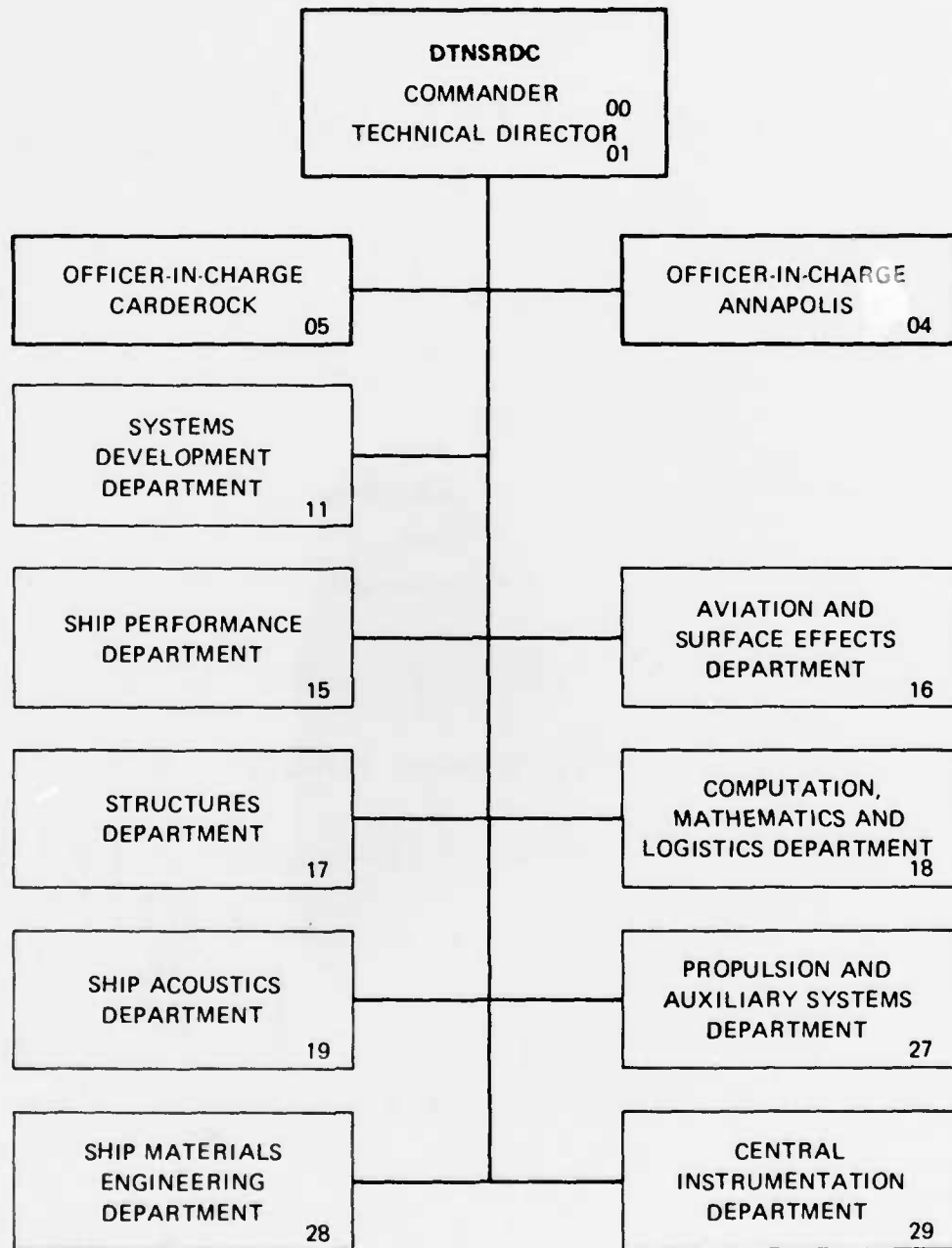
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RESPONSE CHARACTERISTICS OF A SYSTEMATIC SERIES OF 30,000 TON SWATH CONFIGURATIONS

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER DTNSRDC SPD-1072-01	2. AUTHOR ADDRESS A134 858	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) RESPONSE CHARACTERISTICS OF A SYSTEMATIC SERIES OF 30,000 TON SWATH CONFIGURATIONS	5. TYPE OF REPORT & PERIOD COVERED Final	
7. AUTHOR(s) CHARLES R. TURNER and K.K. McCREIGHT	6. PERFORMING ORG. REPORT NUMBER	
9. PERFORMING ORGANIZATION NAME AND ADDRESS Ship Performance Department David Taylor Naval Ship R&D Center Bethesda, Maryland 20084	8. CONTRACT OR GRANT NUMBER(s)	
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Sea Systems Command Washington, D.C.	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS Program Element 63564N Task Area S0408069 Work Unit Number 1-1562-102	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	12. REPORT DATE July 1983	
	13. NUMBER OF PAGES 234	
	15. SECURITY CLASS. (of this report) UNCLASSIFIED	
16. DISTRIBUTION STATEMENT (of this Report) Approved for Public Release: Distribution Unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) SWATH Configurations		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The response characteristics of a systematic series of seventy-nine 30,000-ton appended SWATH configurations with lower hulls having elliptical cross sections have been investigated analytically. Three values each of waterplane area, strut length, longitudinal center of buoyancy, and longitudinal center of flotation are used to define the hullforms. For each configuration, root mean squared values of heave, pitch, relative bow motion, and absolute stern motion are presented for a unit significant wave height and a range of modal		

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periods for head and following seas at four speeds. Performance assessments in which the highest significant wave height for which several seakeeping criteria are not exceeded are given. Trends among the performance assessments for the various configurations are noted and provide a seakeeping reference for the designer for potential 30,000-ton SWATH ships.



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ABSTRACT

The response characteristics of a systematic series of seventy-nine 30,000 ton appended SWATH configurations with lower hulls having elliptical cross sections have been investigated analytically. Three values each of waterplane area, strut length, longitudinal center of buoyancy, and longitudinal center of flotation are used to define the hull-forms. For each configuration, root mean squared values of heave, pitch, relative bow motion, and absolute stern motion are presented for a unit significant wave height and a range of modal periods for head and following seas at four speeds. Performance assessments in which the highest significant wave height for which several seakeeping criteria are not exceeded are given. Trends among the performance assessments for the various configurations are noted and provide a seakeeping reference for the designer for potential 30,000 ton SWATH ships.

ADMINISTRATIVE INFORMATION

This study was sponsored by the Naval Sea Systems Command (NAVSEA), Code 03RD under the CONFORM Program. The work was carried out under Program Element 63564N, Task Area S0408069, Work Unit Number 1-1562-102.

INTRODUCTION

An analytical evaluation of a series of 30,000 ton appended SWATH configurations having lower hulls with elliptical cross sections was conducted using a computer simulation developed at the David Taylor Naval Ship Research and Development Center (DTNSRDC)¹. The study was initiated because little is known about the response characteristics of configurations of this displacement which differ mainly from previously studied configurations in a higher length to beam ratio. This results in significantly longer struts and waterplane areas and potential for application as a vertical short takeoff and landing (VSTOL) aircraft carrier. A representative example of these SWATH configurations is shown in Figure 1.

In order to systematically examine their effect upon the seakeeping characteristics of the series, three values each were considered for waterplane area

(A_w), strut length (L_s), the ratio of the longitudinal center of buoyancy to ship length (LCB/L), and the ratio of the longitudinal center of flotation to ship length (LCF/L). Numerical values for these four variables were selected to represent the full range of hullform variations considered to be of interest for SWATH aircraft carriers in this size range. This selection necessarily reflects existing SWATH designs as well as past monohull design experience. These parameters can be considered to be the independent variables of the analysis and were used as basic input to the simulation for subsequent definition of dependent quantities. Hullforms were generated automatically by an algorithm in the simulation to satisfy specified values of these parameters. Other geometric properties, such as the transverse and longitudinal metacentric heights (GM_T and GM_L), were not specified, but were the by-product of satisfying for the specified values of the independent variables. The matrix of the four variables, A_w , L_s , LCB/L, and LCF/L, when combined in all possible arrangements, results in 81 unique hullforms. Other parameters common to all configurations are given in Table 1.

Root mean squared (RMS) values of heave, pitch, relative bow motion, and absolute stern motion responses and the results of a seakeeping assessment are reported for each stable configuration. Head and following seas at speeds of 0, 15, 20, 25, and 30 knots were included in the analysis.

APPROACH

Employing a recent improvement to a numerical simulation for SWATH seakeeping analysis¹, a parametric evaluation was conducted of a series of 30,000 ton SWATH hullforms by the systematic variation of four input parameters. Due to the large number of resultant variations, a four digit code (IJKL) was used in order to simplify identification of the hullforms. The I, J, K, and L correspond to the values used for A_w , L_s , LCB/L, and LCF/L, respectively. Values used for each of these parameters are listed in Table 2. Note that an increase in each digit from 1 to 3 signifies an increase in the corresponding variable. LCB and LCF are referenced to the leading point of the lower body and therefore, an increase in the value of these two parameters corresponds to a movement aft.

Using values of A_w , L_s , LCB/L, and LCF/L taken from the specified group of parameters as basic input, an algorithm in the computer simulation generated

hull offsets to satisfy the prescribed hydrostatic requirements. An algorithm described in detail in Reference 2 was used to select stabilizing fins by generating a series of 36 fin sets for a range of locations on the lower body and performing a calculation of the vertical plane stability for each set at speeds up to 30 knots in head and following seas. Total fin area was constant for each set, but the area ratio between fore and aft fins did vary. The same set of 36 fin configurations was used for each design, however, to provide standardized results. Based on the analysis, the algorithm then determined the best fin configuration among those considered. In the cases where none of these fin sets provided adequate stability, the computer analysis for that configuration was terminated. Of the 81 potential designs, this occurred for configurations 2131 and 3131. This does not mean that there is no fin arrangement which would provide the required stabilization for these hullforms, but only that stability was not achieved for any of the 36 different fin arrangements examined.

The stabilizing fin area per hull is 152 m^2 (1636 ft^2) which is the area of the SWATH 6A fins scaled to 30,000 tons. The aspect ratio of each fin is 1.5. Particulars of the fin set chosen as best for each configuration and individual ship characteristics including the longitudinal metacentric height (GM_L) are given in Appendix A. As previously stated, the value of GM_L was not specified in this study, but was a function of the other parameters. It should be noted that for a given A_w , an increase in strut length results in an increase in GM_L , and for a given L_s , an increase in waterplane area results in an increase in GM_L .

DISCUSSION OF RESULTS

Heave, pitch, relative bow motion, and absolute stern motion responses are calculated for each configuration using the Bretschneider long crested wave formulation to model the sea spectra. Root mean squared values of responses to a unit significant wave height with modal periods ranging from 3 to 26 seconds are presented for all configurations for 0, 15, 20, and 25 knots. Heave RMS values are given in Figures 2 and 6 (head and following seas), pitch RMS values in Figures 3 and 7, relative bow motion RMS values in Figures 4 and 8, and absolute stern motion RMS values in Figures 5 and 9.

For each configuration, seaworthiness performance is assessed. That is, for each speed and heading combination (180 denotes head seas) the limiting significant wave height (LSWH) for which none of the criteria in Table 3 are exceeded is calculated. These criteria were selected to reflect aircraft carrier operations and have been used in previous studies. The LSWHs for each configuration are presented in Table 4. Data given in Figure 2 to Figure 9 as well as other response characteristics are used in this analysis. Significant wave heights up to 14 meters utilizing the Bretschneider wave spectral formulation are considered. Modal periods used for each significant wave height are those which fall within a 50% confidence band for the North Atlantic region³, i.e., for each significant wave height, there is the probability that modal periods in the range considered will occur 50% of the time in the North Atlantic.

Some general observations can be made based on the seaworthiness assessments and the fact that larger values of LSWH imply a more seaworthy design. Although these observations are true in general, there are some exceptions. Unless otherwise stated, the trends described refer to the entire speed range. The observations are:

- a. Increasing A_w causes a decrease in the LSWH in head seas for all speeds and in following seas for speeds below 15 knots. At higher speeds in following seas, the LSWH increases with an increase in A_w .
- b. For each configuration, the LSWHs at zero speed for head and following seas are close in value.
- c. For each A_w , increasing L_s results in a reduction of the LSWH in head seas and an increase in the LSWH in following seas at all velocities except at zero speed. The LSWH for head seas is generally greater than for following seas for each configuration, although differences for the two headings decrease as L_s increases.
- d. Increasing LCB/L (moving LCB aft) results in a reduction of the LSWH in head seas and a less significant increase in the LSWH in following seas.
- e. Increasing LCF/L (moving LCF aft) generally results in an increase in the LSWH in head seas and a decrease in the LSWH in following seas. Typically, for a fixed A_w and L_s , this effect is reduced as LCB increases.

f. For each A_w and L_s , for each reversal of locations of LCB and LCF (Configurations --k1 and --1k) the LSWH is higher in head seas when the LCB is forward of the LCF and the LSWH is higher in following seas when the LCB is aft of the LCF. This effect diminishes with speed for some configurations. However, for configurations 1332 and 1323 the head seas results are similar and for configurations 2123 and 2132 the following seas results are similar.

For all configurations, only two of the limiting seakeeping criteria listed in Table 3 were responsible for the values of LSWH. These were the 5.5 m single amplitude average of the highest 1/10th relative displacements at the bow (criterion 3) and the 3.5 m significant single amplitude relative displacement at the propeller (criterion 4).

In head seas, for the smallest value of waterplane area ($A_w = 929 \text{ m}^2$) with the LCF located aft of the LCB (configurations 1J12, 1J13, and 1J23), there is a trend toward relative displacement amplitude at the propeller (criterion 4) being the dominant failure mode. For the LCF located forward of the LCB (configurations 1J21, 1J31, and 1J32), the dominant failure mode is relative displacement at the bow (criterion 3). Except for the longest strut length ($L_s = 229 \text{ m}$), the above trends become less apparent as the waterplane area increases and the predominant failure mode for all other configurations is relative displacement at the bow (criterion 3). The largest value of strut length appears to have considerable influence since the failure mode for all I313 configurations in head seas is relative displacement at the propeller (criterion 4). The IJ13 geometry (LCB in the most forward position and LCF farthest aft) undoubtedly has some influence although its effect is lost for the 191 m and 152 m struts at waterplane area values of 929 m^2 and 1394 m^2 . No speed dependent trends are apparent in head seas.

In following seas, the predominant failure mode is relative displacement at the bow (criterion 3). This is true for all configurations except for the 33KL series where the dominant failure mode is criterion 4, independent of the relative locations of the LCB and LCF. As with head seas, there is no apparent speed dependency.

CONCLUSIONS

The data in this report provide a reference for the designer considering the seakeeping characteristics of potential 30,000 ton SWATH configurations. This study investigates the impact of changes in A_w , L_s , LCB, and LCF on the seakeeping characteristics in head and following seas only. Sensitivity of the SWATH seakeeping characteristics to changes in other design parameters such as proportions of the elliptical lower hull, fin area, and cross-structure clearance, or to other headings, has not been determined.

The trends noted are for limiting significant wave heights which are a function of the seakeeping criteria utilized. Selection of one hullform as best will depend upon the desired performance for a specific mission. Regression analysis of the data is recommended to elucidate the relationship between hullform characteristics and superior motion characteristics.

ACKNOWLEDGMENTS

The authors wish to thank Dr. Colen Kennell of NAVSEA, Mr. Christopher Loesser of NAVSEA, and Mr. G. Robert Lamb of DTNSRDC for aiding in the definition of the characteristics of the hullforms to be investigated.

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TABLE 1 - CHARACTERISTICS OF HULLFORMS

Displacement	30,481 Tonnes	30,000 LTSW
Draft	11.6 m	38.0 ft
Length of lower hull (L)	228.6 m	750.0 ft
Vertical center of gravity (KG)	14.6 m	48.0 ft
Centerline to centerline hull separation	39.0 m	128.0 ft
Total Fin Area	152 m ²	1636 ft ²
Lower hull prismatic coefficient (C_p)	0.94	0.94
Waterplane area coefficient (C_{wp})	0.80	0.80
Axis ratio of elliptical lower hull (transverse cross section)	1.78	1.78

TABLE 2 - CHARACTERISTICS AND CODE FOR CONFIGURATION IJKL

A_w m ² (ft ²)		L_s m (ft)		LCB/L		LCF/L	
I		J		K		L	
1	929 (10,000)	1	152 (500)	1	0.46	1	0.46
2	1394 (15,000)	2	191 (625)	2	0.50	2	0.50
3	1858 (20,000)	3	229 (750)	3	0.54	3	0.54

TABLE 3 - LIMITING SEAKEEPING CRITERIA

(1)	4.8°	significant single amplitude pitch
(2)	0.4 g's	significant single amplitude vertical acceleration at station 1.4 — 16.0 m (52.5 ft) aft of forward point of elliptical lower body
(3)	5.5 m (18.0 ft)	single amplitude average of highest 1/10th relative displacement at the bow
(4)	3.5 m (11.5 ft)	significant single amplitude relative displacement at the propeller
(5)	30.0	wetnesses per hour
(6)	20.0	slams per hour

TABLE 4 - SEAKEEPING PERFORMANCE ASSESSMENTS*

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	7.9	8.6	0	8.1	8.1	0	5.1	5.3
15	8.9	2.9	15	8.9	2.7	15	8.4	3.2
20	9.3	2.1	20	14.0	2.3	20	8.5	2.4
25	8.9	.8	25	8.4	.9	25	8.7	.7
30	8.8	1.7	30	8.7	1.9	30	8.7	1.9
CONFIGURATION	1111		CONFIGURATION	1121		CONFIGURATION	1131	

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	7.6	7.3	0	8.8	8.8	0	8.0	8.5
15	9.3	3.6	15	9.0	2.9	15	8.8	2.8
20	9.7	2.1	20	9.3	2.1	20	14.0	2.3
25	9.8	.9	25	9.3	.8	25	8.2	.8
30	9.7	2.0	30	8.9	2.0	30	8.5	2.0
CONFIGURATION	1112		CONFIGURATION	1122		CONFIGURATION	1132	

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	5.7	6.1	0	7.8	7.1	0	9.1	9.0
15	9.4	3.9	15	9.4	3.7	15	9.2	3.4
20	9.7	1.9	20	9.8	2.1	20	9.5	2.3
25	10.0	.5	25	9.8	.6	25	9.1	.7
30	9.9	2.0	30	9.7	2.3	30	9.3	2.4
CONFIGURATION	1113		CONFIGURATION	1123		CONFIGURATION	1133	

* For each configuration for each speed and heading, the limiting significant wave height (LSWH) is given in meters. The LSWH is the largest significant wave height for which none of the criteria in Table 3 are exceeded (180 denotes head seas).

TABLE 4 - SEAKEEPING PERFORMANCE ASSESSMENTS (Continued)

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	8.8	8.7	0	7.6	8.3	0	6.1	6.8
15	8.7	3.0	15	8.2	3.4	15	8.1	4.2
20	8.4	3.0	20	8.3	3.4	20	8.1	3.7
25	8.6	3.1	25	8.4	3.0	25	8.3	3.1
30	8.6	2.8	30	8.4	2.5	30	8.4	2.2
CONFIGURATION	1211		CONFIGURATION	1221		CONFIGURATION	1231	
SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	7.6	7.0	0	9.8	8.9	0	7.8	8.2
15	8.8	3.1	15	8.8	3.0	15	8.0	3.3
20	8.8	2.3	20	8.4	2.9	20	8.1	3.2
25	8.8	2.4	25	8.6	2.9	25	8.3	3.0
30	8.8	2.1	30	8.7	2.6	30	8.3	2.4
CONFIGURATION	1212		CONFIGURATION	1222		CONFIGURATION	1232	
SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	5.4	5.8	0	7.6	6.9	0	10.0	9.3
15	8.9	3.8	15	8.8	3.3	15	8.9	3.0
20	9.2	2.4	20	8.8	2.3	20	8.3	2.8
25	9.4	2.2	25	8.8	2.3	25	8.4	3.0
30	9.5	2.1	30	8.7	2.0	30	8.5	2.7
CONFIGURATION	1213		CONFIGURATION	1223		CONFIGURATION	1233	

TABLE 4 - SEAKEEPING PERFORMANCE ASSESSMENTS (Continued)

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	6.7	6.7	0	6.8	6.8	0	5.8	5.9
15	7.6	2.8	15	7.1	4.1	15	7.3	3.9
20	7.6	4.0	20	7.1	5.1	20	7.4	4.7
25	7.7	4.4	25	7.5	5.5	25	7.1	4.9
30	7.7	4.3	30	7.8	5.2	30	7.2	4.3
CONFIGURATION	1311		CONFIGURATION	1321		CONFIGURATION	1331	

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	6.6	6.2	0	6.8	6.8	0	7.2	7.1
15	8.3	2.2	15	7.7	2.8	15	7.8	3.9
20	9.5	3.0	20	7.7	3.9	20	7.8	4.9
25	9.5	3.7	25	7.7	4.3	25	7.3	5.3
30	8.6	3.5	30	7.7	4.2	30	7.6	5.1
CONFIGURATION	1312		CONFIGURATION	1322		CONFIGURATION	1332	

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	5.4	5.2	0	6.6	6.3	0	6.9	6.9
15	7.6	3.7	15	7.9	2.3	15	7.9	2.7
20	7.8	2.9	20	8.4	2.8	20	7.9	3.8
25	7.9	3.0	25	8.4	3.5	25	7.9	4.0
30	7.9	2.7	30	8.4	3.4	30	7.9	4.3
CONFIGURATION	1313		CONFIGURATION	1323		CONFIGURATION	1333	

TABLE 4 - SEAKEEPING PERFORMANCE ASSESSMENTS (Continued)

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	4.7	5.4	0	4.0	4.4
15	7.6	2.8	15	5.9	3.2
20	7.8	2.7	20	7.1	3.0
25	8.1	1.7	25	7.1	1.8
30	8.2	1.6	30	7.4	1.8
CONFIGURATION	2111		CONFIGURATION	2121	

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	4.3	4.5	0	4.7	5.1	0	4.0	4.3
15	8.3	2.6	15	7.2	3.1	15	6.0	3.5
20	8.5	2.4	20	8.0	2.6	20	7.1	2.9
25	8.4	2.0	25	8.2	1.7	25	7.1	1.9
30	8.4	1.6	30	8.3	1.6	30	7.4	1.9
CONFIGURATION	2112		CONFIGURATION	2122		CONFIGURATION	2132	

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	3.6	3.5	0	4.4	4.5	0	5.0	5.0
15	7.8	2.7	15	8.6	3.0	15	7.3	3.3
20	9.3	2.0	20	8.7	2.3	20	8.1	2.6
25	9.5	1.8	25	8.6	1.9	25	8.3	1.7
30	9.3	1.5	30	9.5	1.8	30	8.3	1.8
CONFIGURATION	2113		CONFIGURATION	2123		CONFIGURATION	2133	

TABLE 4 - SEAKEEPING PERFORMANCE ASSESSMENTS (Continued)

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	5.7	5.2	0	4.6	4.8	0	4.1	4.2
15	6.5	4.3	15	6.2	4.9	15	5.1	4.8
20	7.4	4.8	20	6.2	5.0	20	5.8	5.8
25	7.1	4.8	25	6.9	4.7	25	5.6	5.3
30	7.2	4.5	30	7.3	4.7	30	6.2	4.5
CONFIGURATION	2211		CONFIGURATION	2221		CONFIGURATION	2231	

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	4.3	4.6	0	5.2	5.7	0	4.9	4.9
15	7.8	2.8	15	6.8	3.8	15	5.2	4.6
20	8.1	3.7	20	7.6	4.5	20	6.3	4.8
25	8.2	3.9	25	7.3	4.5	25	7.0	4.6
30	8.2	3.7	30	7.4	4.3	30	7.3	3.8
CONFIGURATION	2212		CONFIGURATION	2222		CONFIGURATION	2232	

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	4.3	3.6	0	4.2	4.3	0	5.7	4.9
15	8.1	2.0	15	8.0	2.5	15	6.6	2.2
20	9.0	2.8	20	8.3	3.5	20	7.3	3.5
25	8.9	3.3	25	8.3	3.8	25	7.1	3.9
30	8.8	3.2	30	8.3	3.7	30	7.2	3.7
CONFIGURATION	2213		CONFIGURATION	2223		CONFIGURATION	2233	

TABLE 4 - SEAKEEPING PERFORMANCE ASSESSMENTS (Continued)

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	5.6	4.9	0	4.4	4.8	0	4.6	5.9
15	5.7	6.5	15	4.9	8.3	15	5.0	6.6
20	6.7	6.8	20	6.1	8.5	20	5.3	8.6
25	7.1	6.7	25	6.0	7.8	25	5.1	7.7
30	7.3	6.5	30	6.5	7.6	30	5.7	6.7
CONFIGURATION 2311			CONFIGURATION 2321			CONFIGURATION 2331		

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	5.0	3.4	0	5.7	5.6	0	4.7	5.1
15	6.3	4.1	15	5.1	5.3	15	5.6	6.8
20	5.9	5.2	20	6.2	5.9	20	5.5	6.7
25	7.1	5.5	25	6.6	6.0	25	6.3	6.4
30	7.3	5.4	30	6.7	5.8	30	6.7	5.7
CONFIGURATION 2312			CONFIGURATION 2322			CONFIGURATION 2332		

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	4.4	3.7	0	4.8	3.3	0	6.1	5.6
15	5.7	2.4	15	6.1	3.8	15	5.8	5.9
20	6.2	4.1	20	6.8	4.9	20	5.9	6.4
25	6.8	4.5	25	7.1	5.3	25	6.4	6.4
30	6.9	4.5	30	7.2	5.2	30	6.6	6.2
CONFIGURATION 2313			CONFIGURATION 2323			CONFIGURATION 2333		

TABLE 4 - SEAKEEPING PERFORMANCE ASSESSMENTS (Continued)

SPEED (KNOTS)	180		SPEED (KNOTS)	180	0
0	4.1	4.0	0	3.4	3.7
15	5.9	3.0	15	5.1	3.1
20	6.1	3.7	20	5.6	3.5
25	5.4	3.2	25	5.9	2.7
30	6.1	2.7	30	5.2	2.2

CONFIGURATION 3111

CONFIGURATION 3121

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	3.0	3.0	0	4.0	3.8	0	3.4	3.6
15	6.3	2.4	15	6.0	3.0	15	5.2	3.2
20	6.7	3.0	20	6.3	3.6	20	5.5	3.5
25	7.2	2.8	25	5.5	3.2	25	5.9	2.8
30	7.1	2.5	30	6.3	3.0	30	5.3	2.4

CONFIGURATION 3112

CONFIGURATION 3122

CONFIGURATION 3132

SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0	SPEED (KNOTS)	180	0
0	2.6	2.8	0	3.0	3.0	0	4.0	3.9
15	5.9	2.6	15	6.7	2.6	15	5.0	3.2
20	7.5	2.7	20	7.1	2.9	20	6.4	3.7
25	8.1	2.6	25	7.6	2.8	25	5.7	3.4
30	8.3	2.4	30	7.4	2.7	30	5.6	3.4

CONFIGURATION 3113

CONFIGURATION 3123

CONFIGURATION 3133

TABLE 4 - SEAKEEPING PERFORMANCE ASSESSMENTS (Continued)

SPEED (KNOTS)	180	0
0	4.1	3.8
15	5.4	4.3
20	5.6	5.2
25	6.1	5.0
30	5.7	4.4

CONFIGURATION 3211

SPEED (KNOTS)	180	0
0	3.5	4.7
15	4.7	4.4
20	5.1	5.3
25	5.2	5.5
30	5.7	4.8

CONFIGURATION 3221

SPEED (KNOTS)	180	0
0	3.9	4.4
15	4.5	4.1
20	4.5	5.1
25	4.8	5.7
30	5.0	5.0

CONFIGURATION 3231

SPEED (KNOTS)	180	0
0	3.9	3.0
15	5.3	3.9
20	5.8	4.6
25	6.5	4.6
30	7.0	4.5

CONFIGURATION 3212

SPEED (KNOTS)	180	0
0	4.0	3.7
15	5.1	4.4
20	5.3	5.3
25	5.0	5.2
30	5.6	5.0

CONFIGURATION 3222

SPEED (KNOTS)	180	0
0	3.5	4.7
15	4.7	4.2
20	5.0	5.2
25	5.2	5.2
30	5.8	4.6

CONFIGURATION 3232

SPEED (KNOTS)	180	0
0	3.5	3.0
15	5.8	2.8
20	7.1	3.9
25	7.5	4.0
30	7.7	4.1

CONFIGURATION 3213

SPEED (KNOTS)	180	0
0	3.8	3.0
15	5.7	3.7
20	6.3	4.4
25	6.8	4.5
30	7.2	4.4

CONFIGURATION 3223

SPEED (KNOTS)	180	0
0	4.2	3.6
15	5.7	4.3
20	5.0	4.7
25	5.4	4.6
30	5.0	4.1

CONFIGURATION 3233

TABLE 4 - SEAKEEPING PERFORMANCE ASSESSMENTS (Continued)

SPEED (KNOTS)	180	0
0	3.8	3.4
15	4.3	5.0
20	4.2	5.3
25	14.0	5.4
30	4.4	5.4

CONFIGURATION 3311

SPEED (KNOTS)	180	0
0	4.0	4.0
15	4.5	6.2
20	4.9	7.1
25	4.9	7.6
30	5.2	6.8

CONFIGURATION 3321

SPEED (KNOTS)	180	0
0	4.1	4.4
15	4.2	5.1
20	4.2	5.7
25	4.6	5.8
30	4.7	5.6

CONFIGURATION 3331

SPEED (KNOTS)	180	0
0	3.8	2.6
15	5.3	5.1
20	5.4	5.3
25	5.6	5.3
30	5.7	5.2

CONFIGURATION 3312

SPEED (KNOTS)	180	0
0	4.3	3.4
15	4.2	5.2
20	4.4	5.5
25	4.1	5.6
30	4.6	5.6

CONFIGURATION 3322

SPEED (KNOTS)	180	0
0	3.8	3.7
15	4.5	6.4
20	4.8	7.3
25	4.9	7.1
30	5.3	6.4

CONFIGURATION 3332

SPEED (KNOTS)	180	0
0	4.6	3.4
15	6.2	4.5
20	5.8	5.2
25	5.7	5.4
30	6.7	5.4

CONFIGURATION 3313

SPEED (KNOTS)	180	0
0	4.0	2.8
15	5.8	5.5
20	5.9	5.7
25	5.9	5.8
30	5.8	5.6

CONFIGURATION 3323

SPEED (KNOTS)	180	0
0	4.0	3.6
15	4.1	5.7
20	4.5	6.0
25	4.2	6.1
30	4.7	6.0

CONFIGURATION 3333

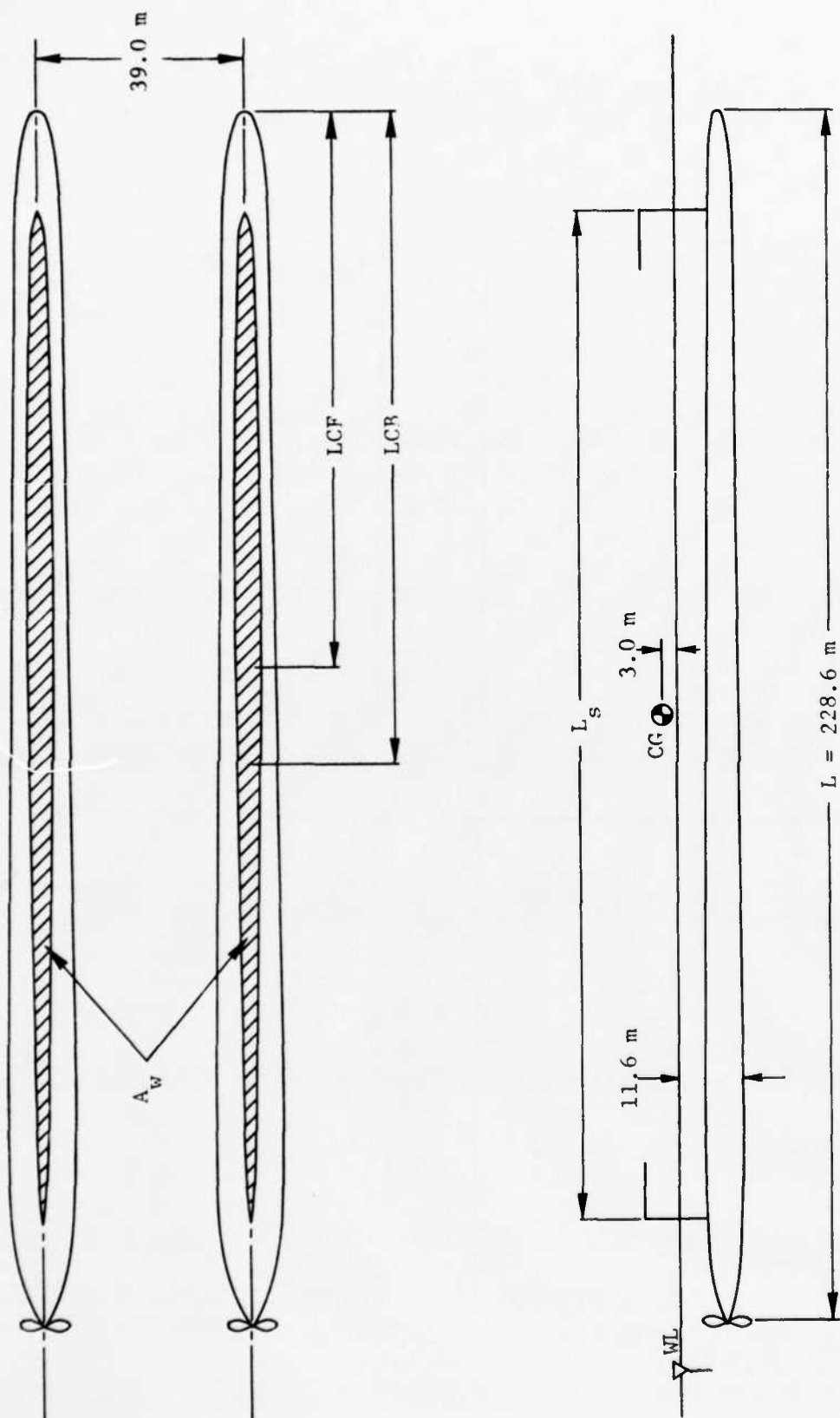


Figure 1 - Sketch of Typical SWATH Configuration

FIGURE 2 - HEAVE RMS RESPONSES IN HEAD SEAS

1111 —————
 1112 - - - - -
 1113 — · — · —

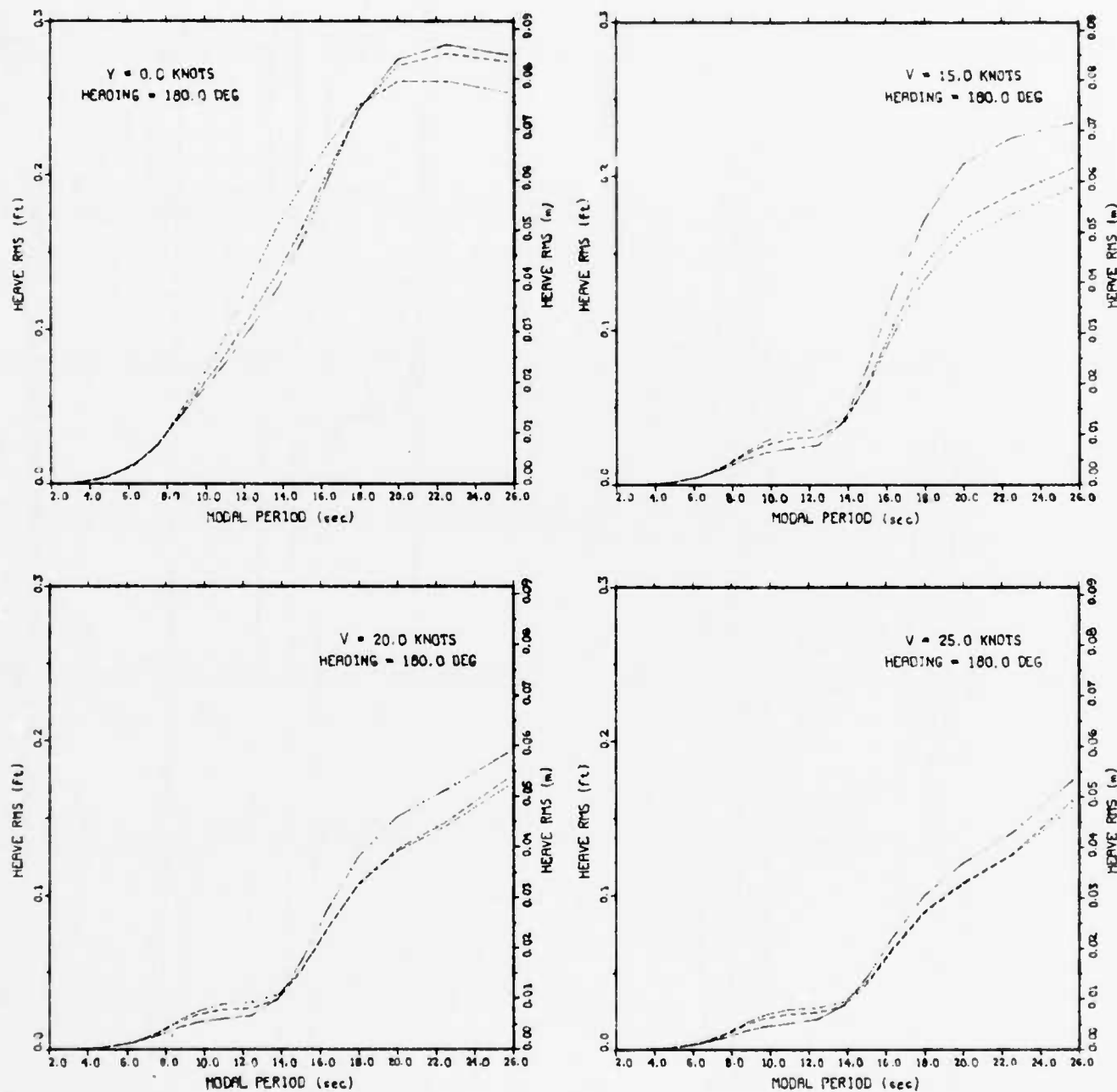


Figure 2a - Responses for Configurations 1111, 1112, and 1113

FIGURE 2 - CONTINUED

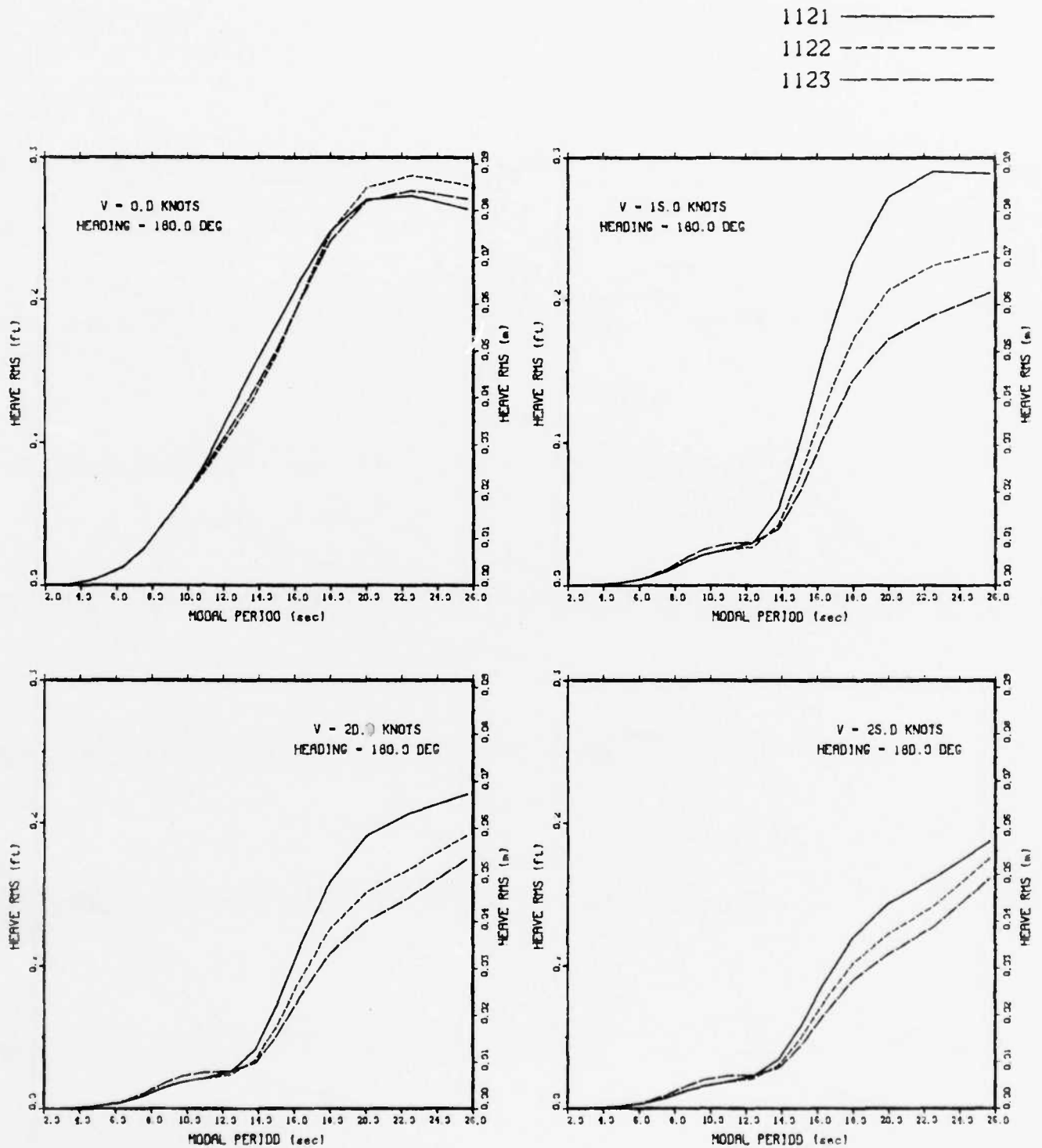


Figure 2b - Responses for Configurations 1121, 1122, and 1123

FIGURE 2 - CONTINUED

1131 —————
 1132 - - - - -
 1133 - - - - -

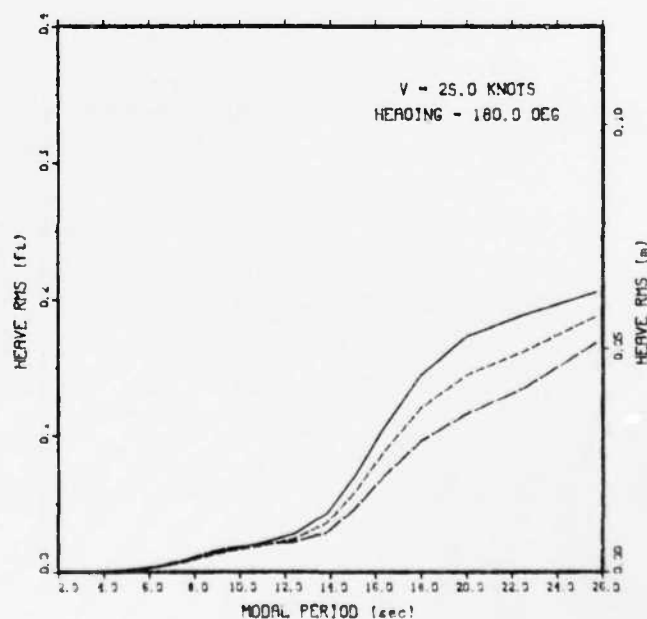
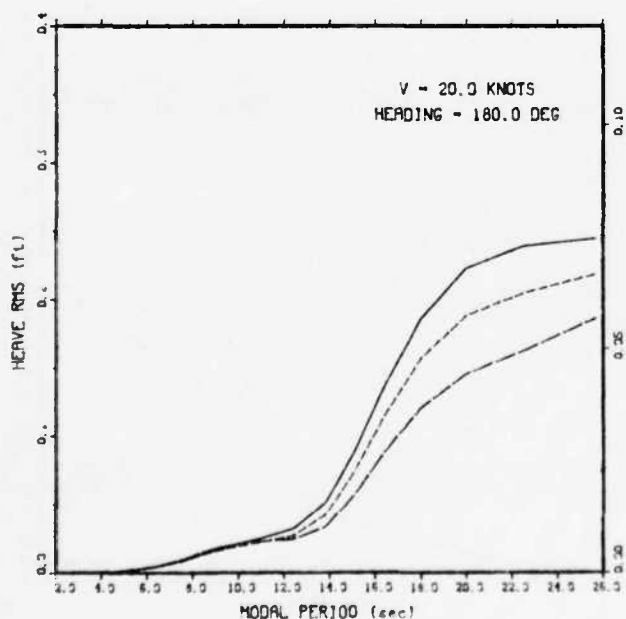
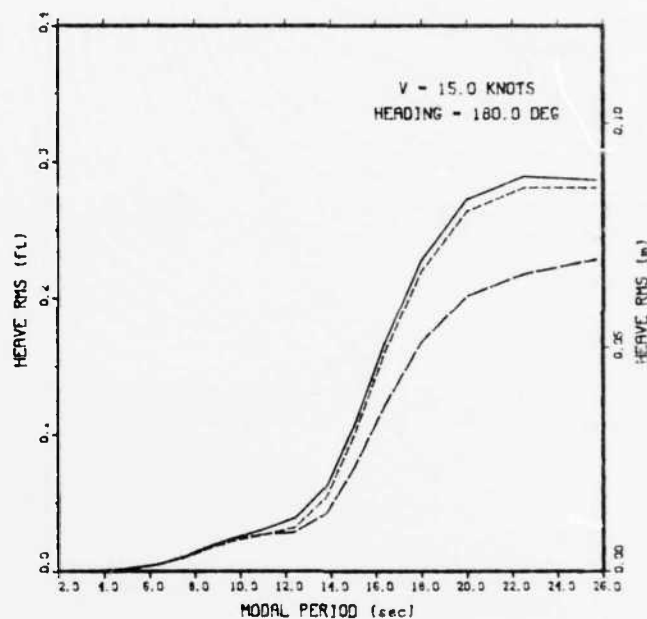
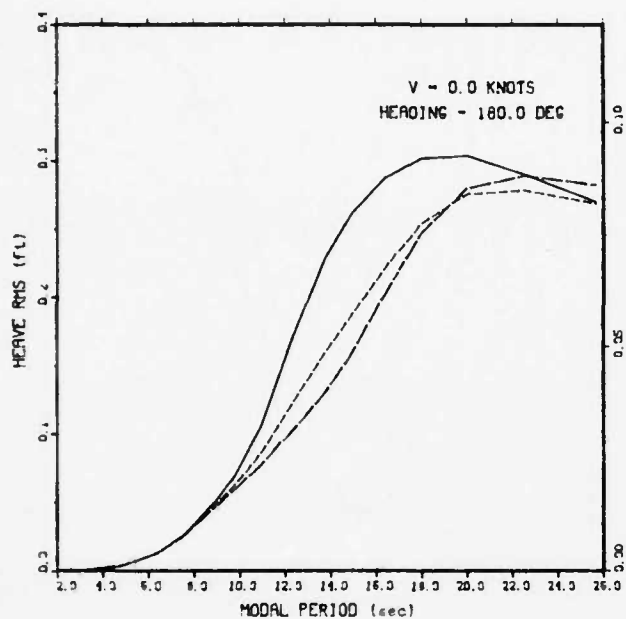


Figure 2c - Responses for Configurations 1131, 1132, and 1133

FIGURE 2 - CONTINUED

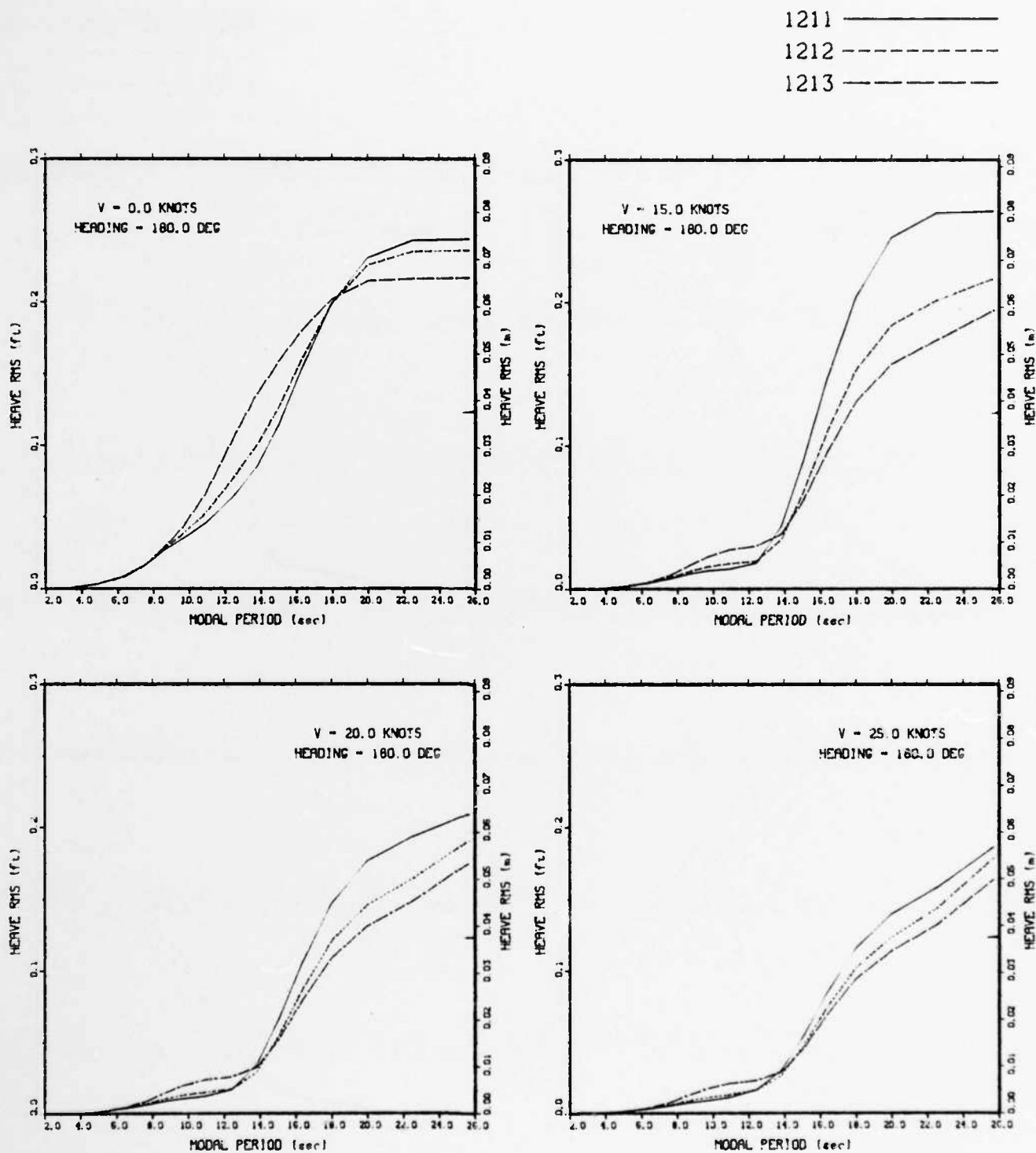


Figure 2d - Responses for Configurations 1211,1212, and 1213

FIGURE 2 - CONTINUED

1221 —————
1222 - - - - -
1223 - - - - -

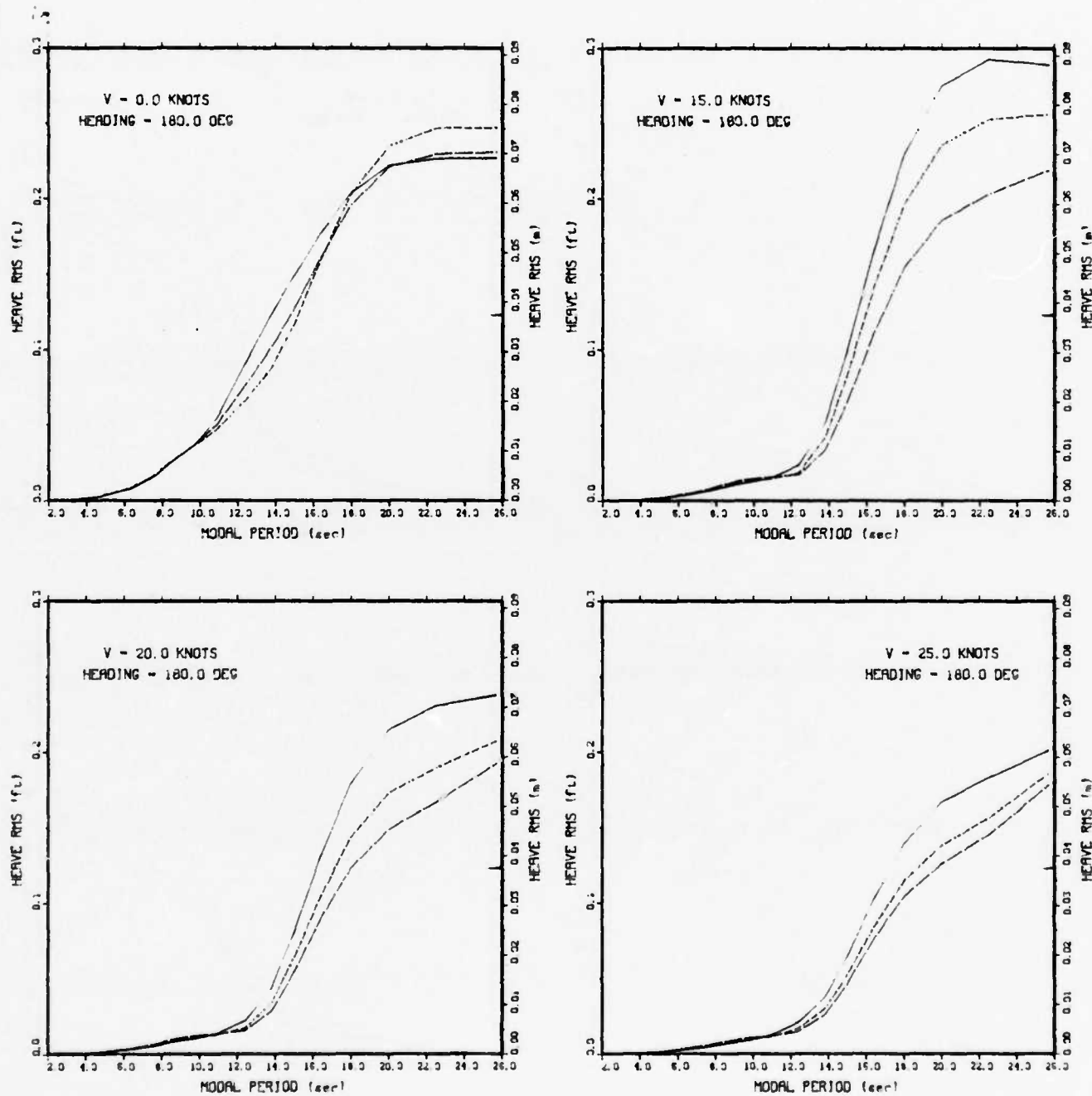


Figure 2e - Responses for Configurations 1221,1222, and 1223

FIGURE 2 - CONTINUED

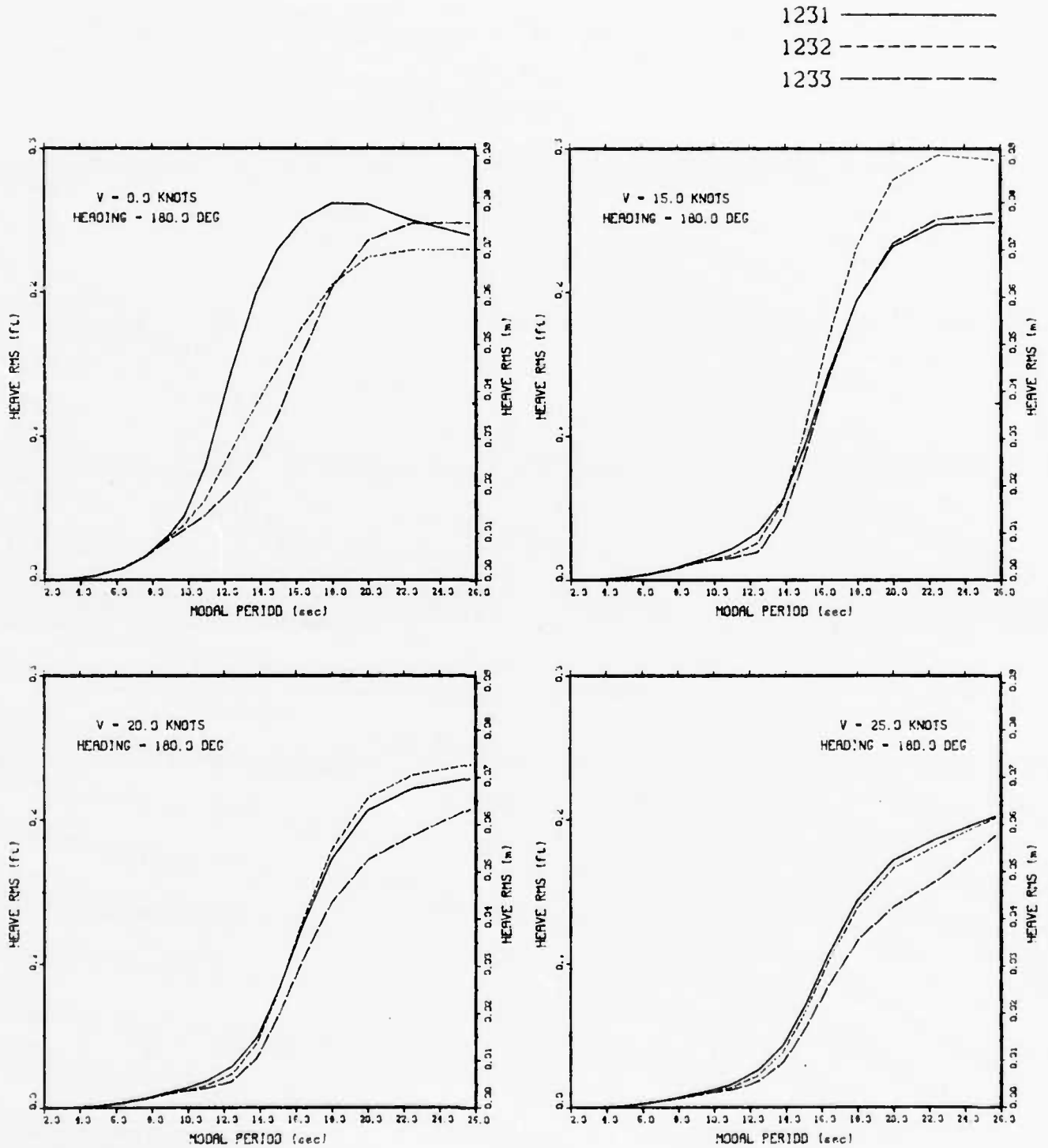


Figure 2f - Responses for Configurations 1231, 1232, and 1233

FIGURE 2 - CONTINUED

1311 —————
 1312 - - - - -
 1313 ————

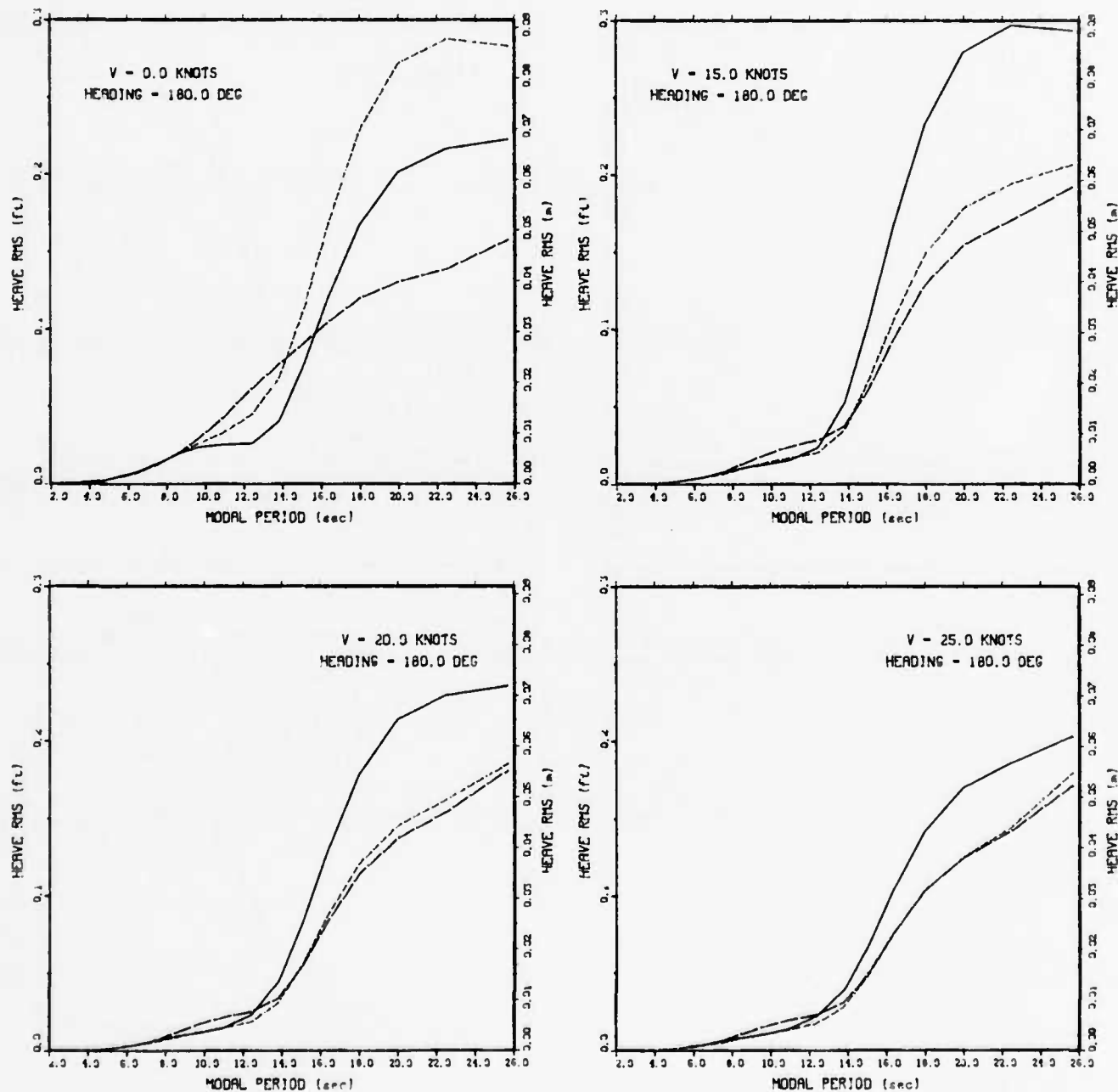


Figure 2g - Responses for Configurations 1311, 1312, and 1313

FIGURE 2 - CONTINUED

1321 —————
 1322 - - - - -
 1323 - - - - -

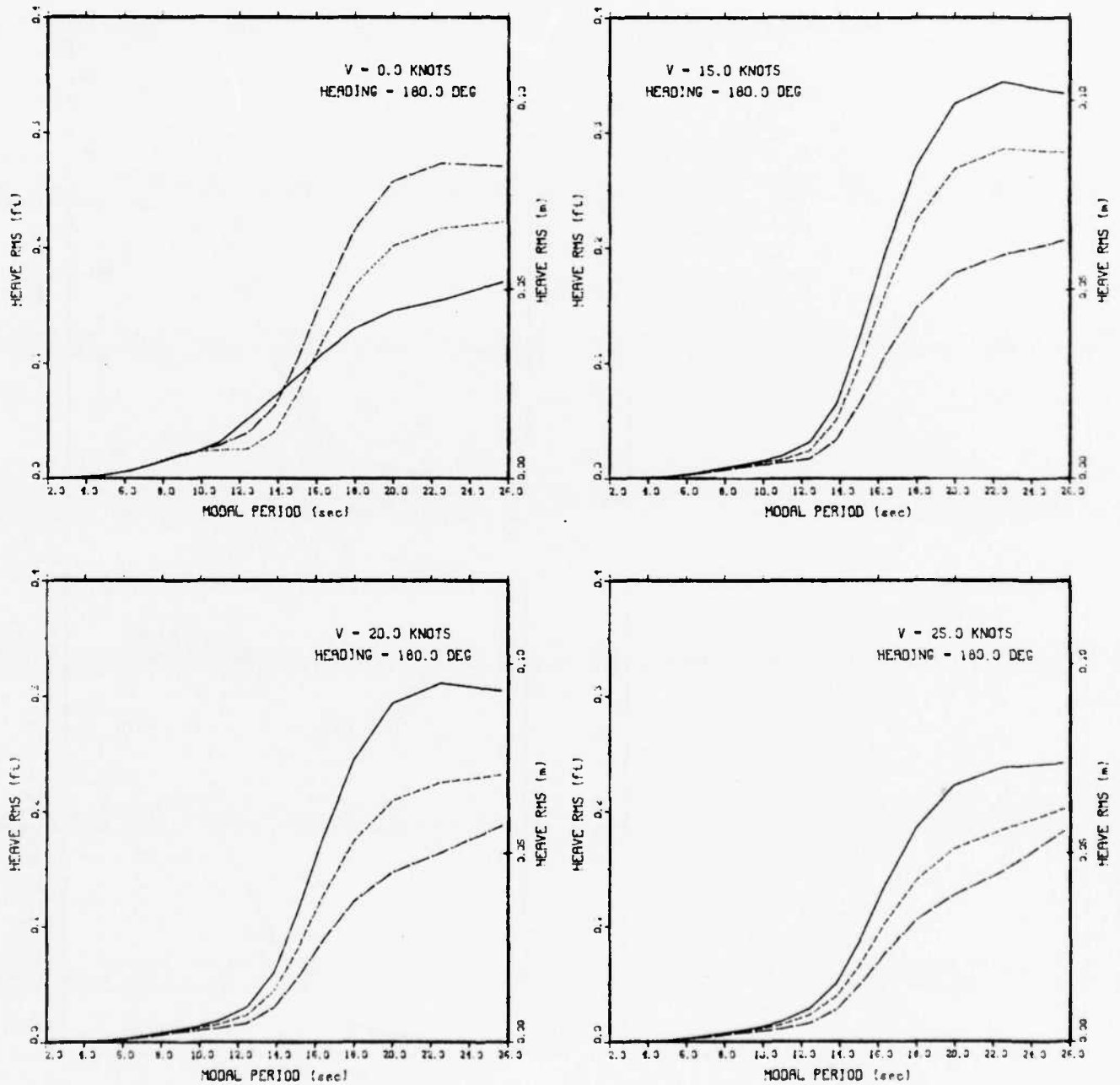


Figure 2h - Responses for Configurations 1321, 1322, and 1323

FIGURE 2 - CONTINUED

1331 —————
 1332 - - - - -
 1333 —————

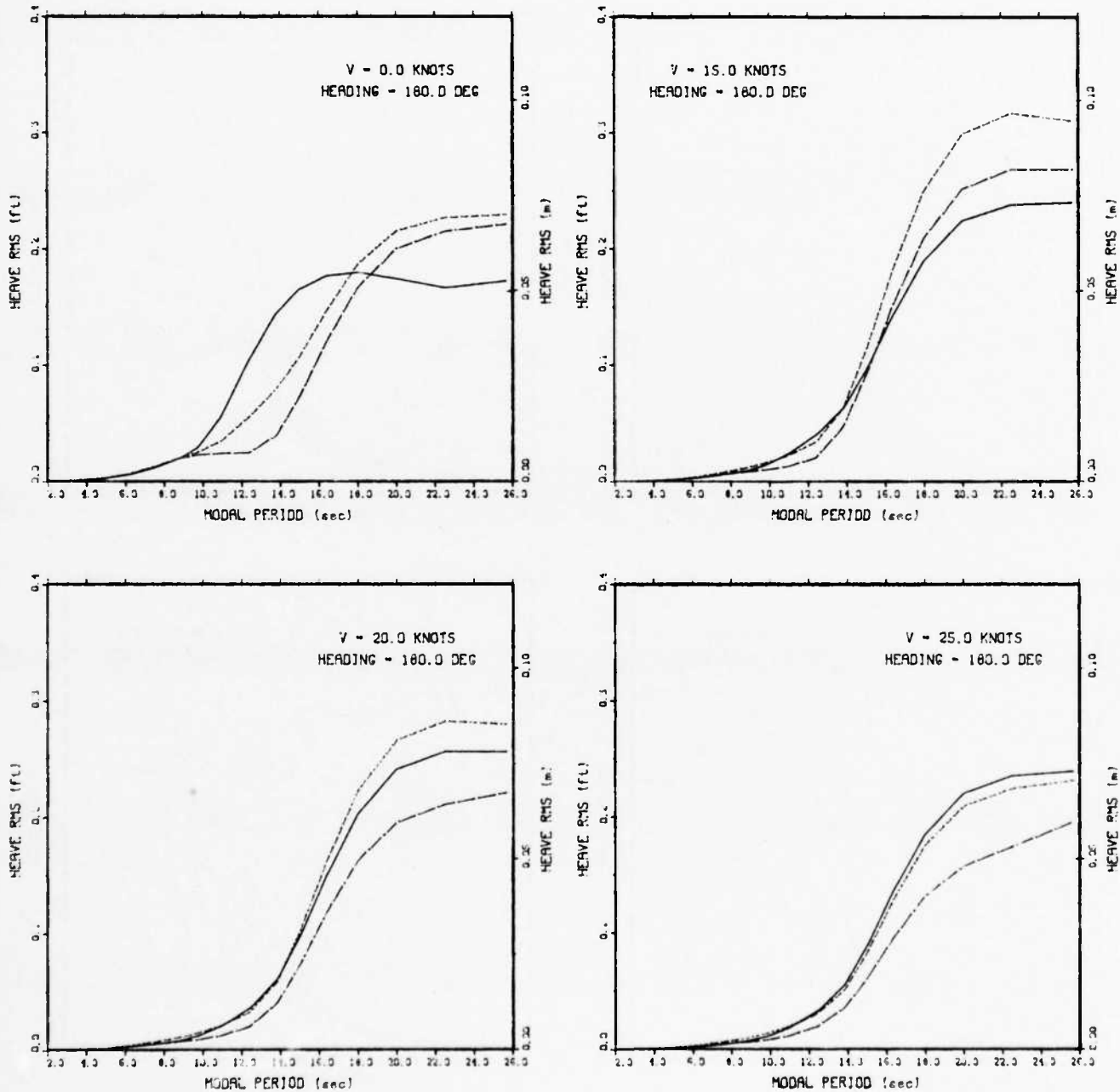


Figure 2i - Responses for Configurations 1331, 1332, and 1333

FIGURE 2 - CONTINUED

2111 —————
 2112 - - - - -
 2113 ————

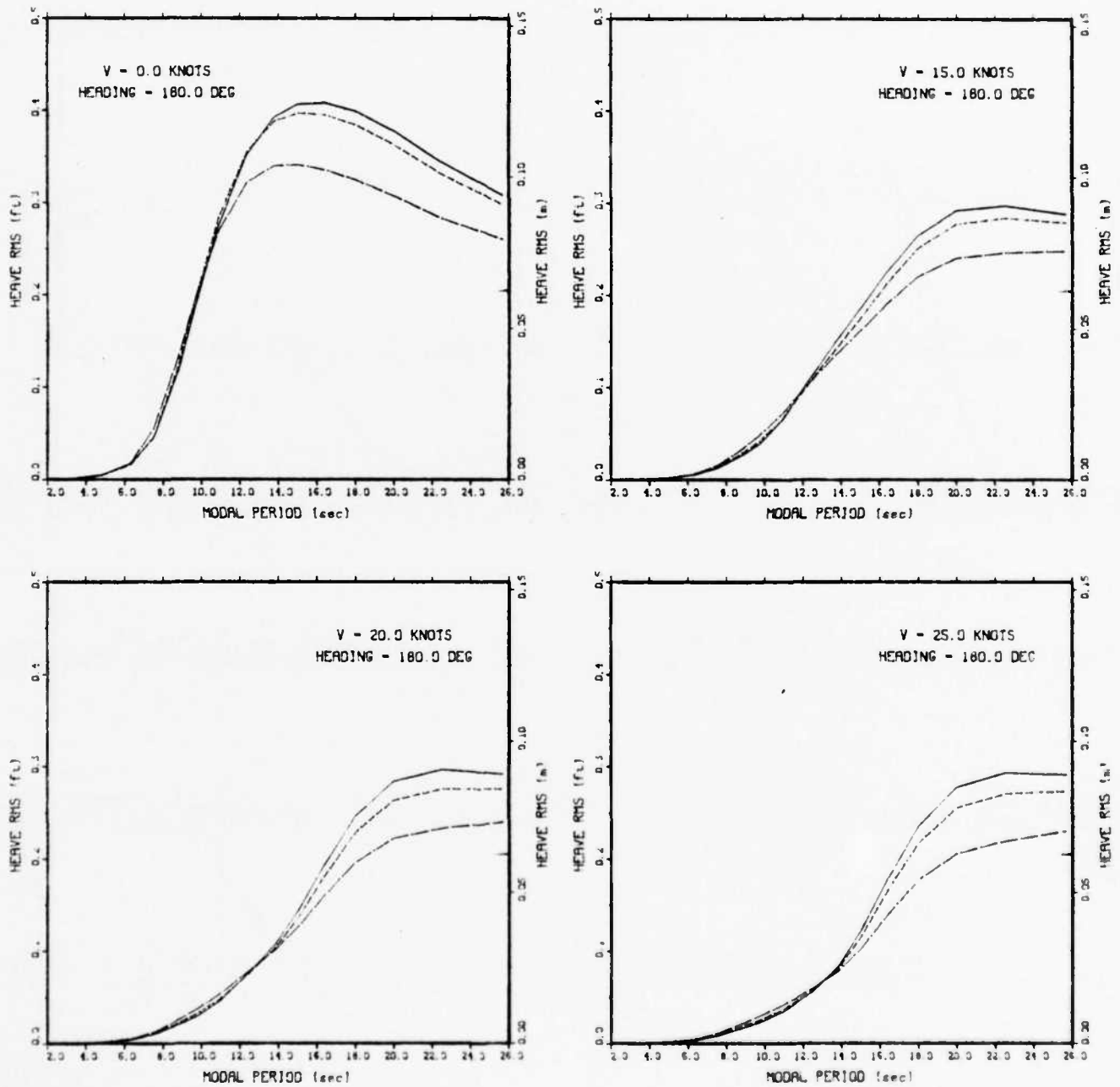


Figure 2j - Responses for Configurations 2111, 2112, and 2113

FIGURE 2 - CONTINUED

2121 —————
 2122 - - - - -
 2123 ————

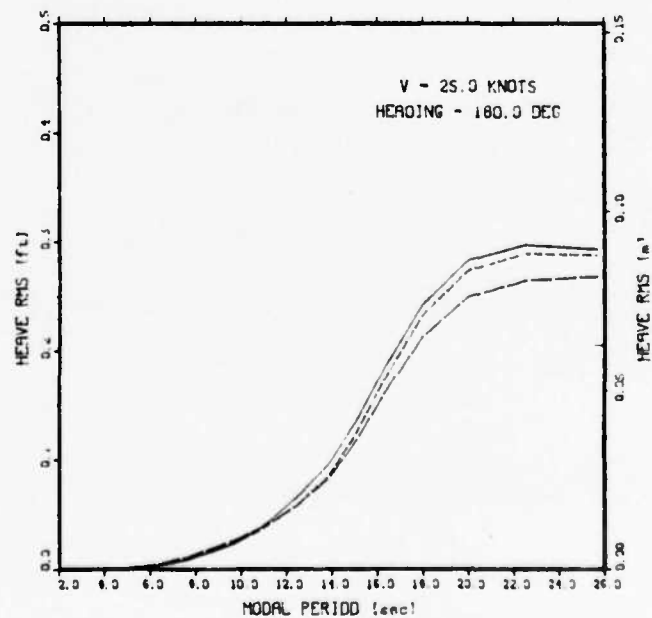
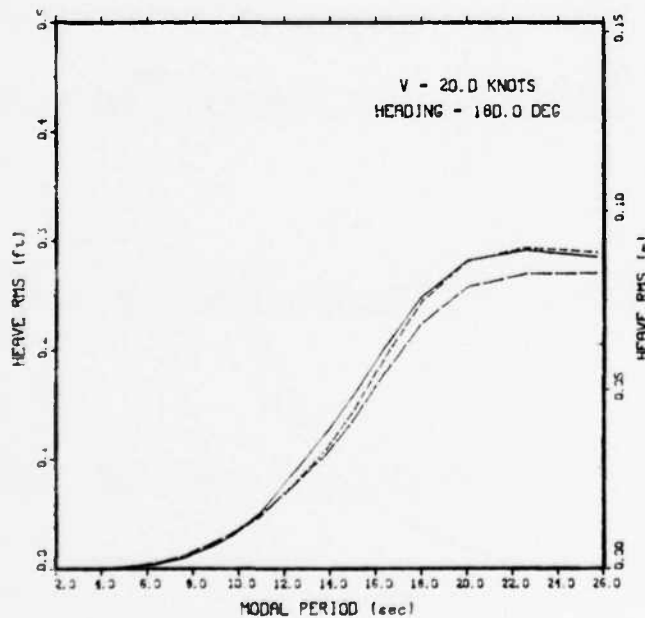
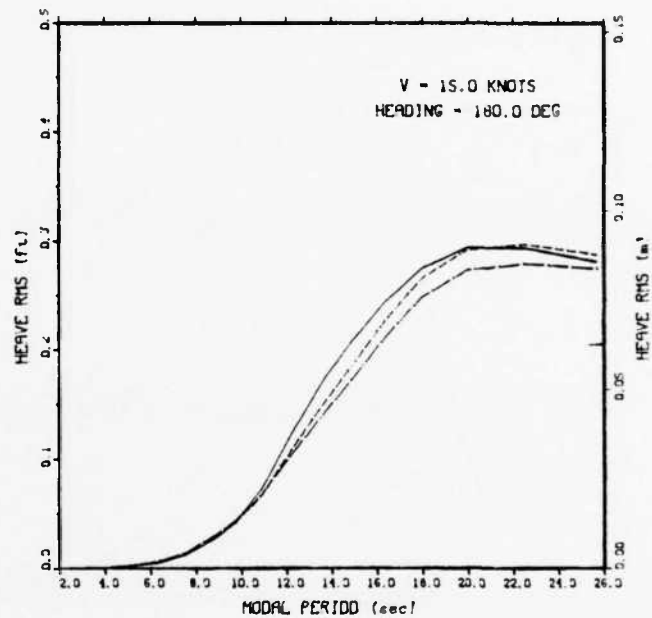
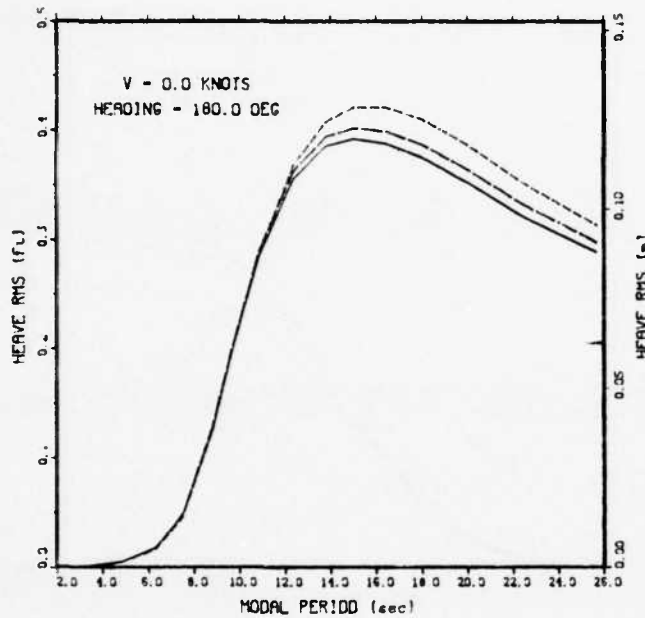


Figure 2k - Responses for Configurations 2121, 2122, and 2123

FIGURE 2 - CONTINUED

2132 - - - - -
2133 - - - - -

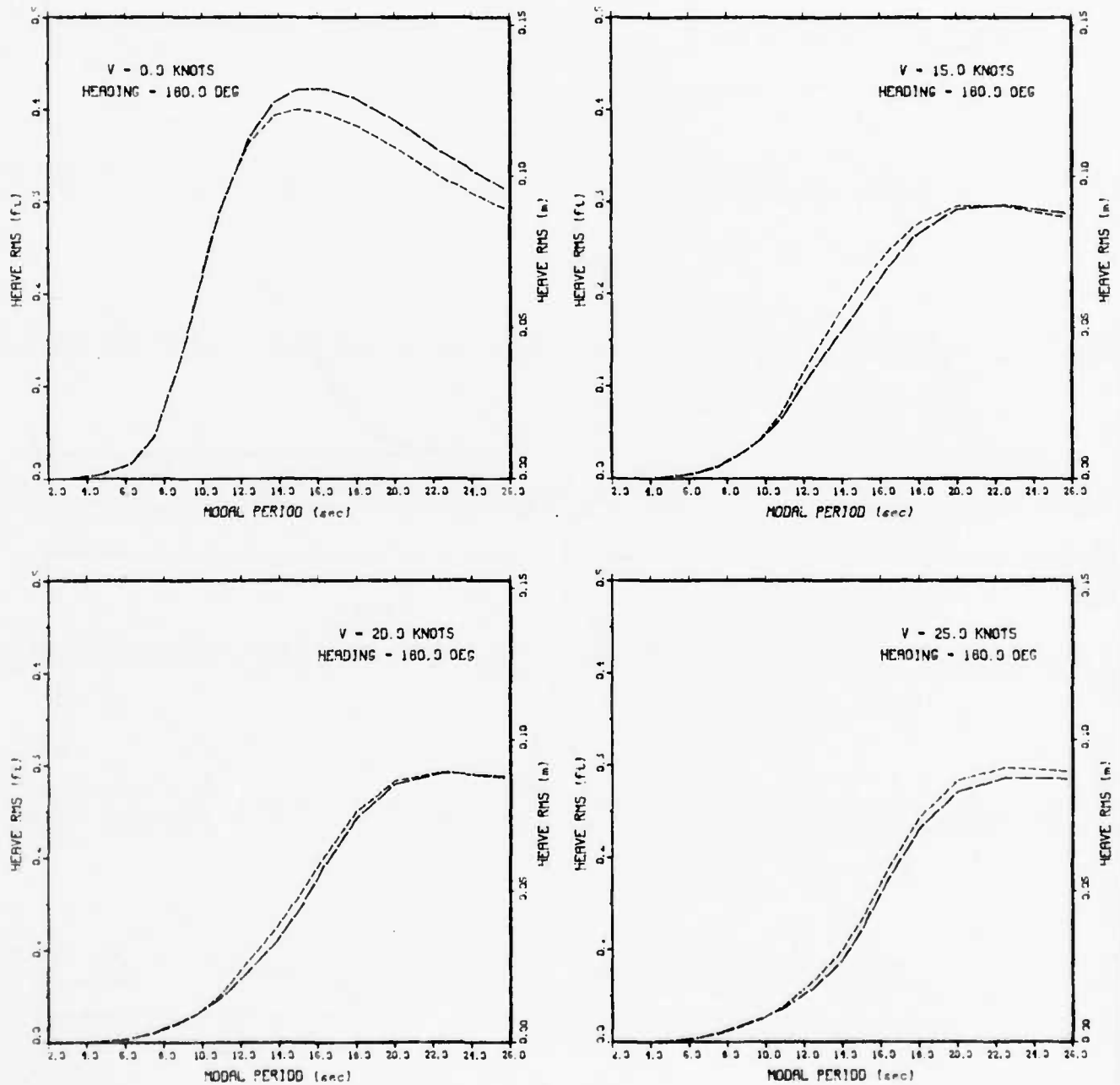


Figure 21 - Responses for Configurations 2132 and 2133

FIGURE 2 - CONTINUED

2211 —————
 2212 - - - - -
 2213 ————

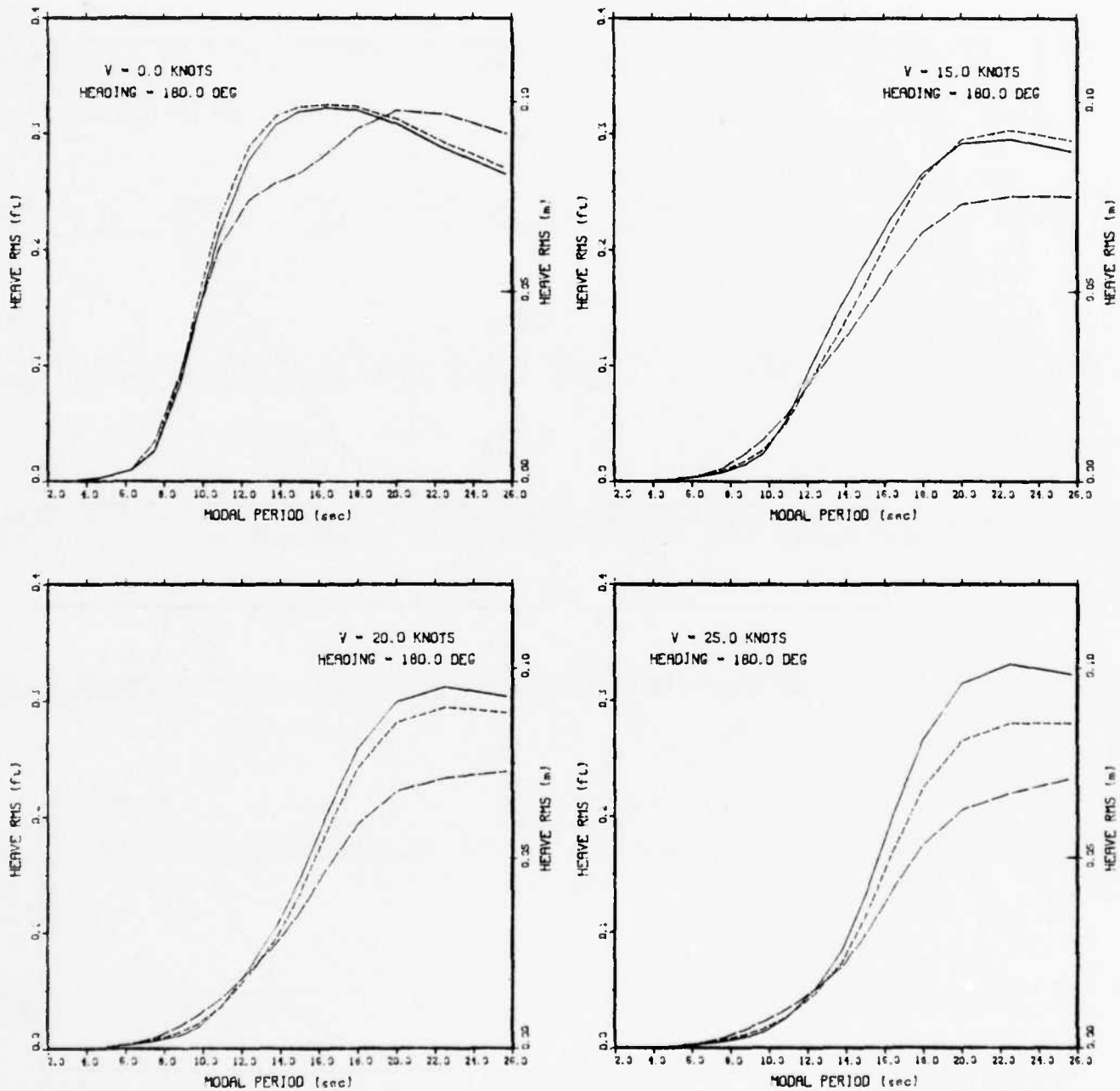


Figure 2m - Responses for Configurations 2211, 2212, and 2213

FIGURE 2 - CONTINUED

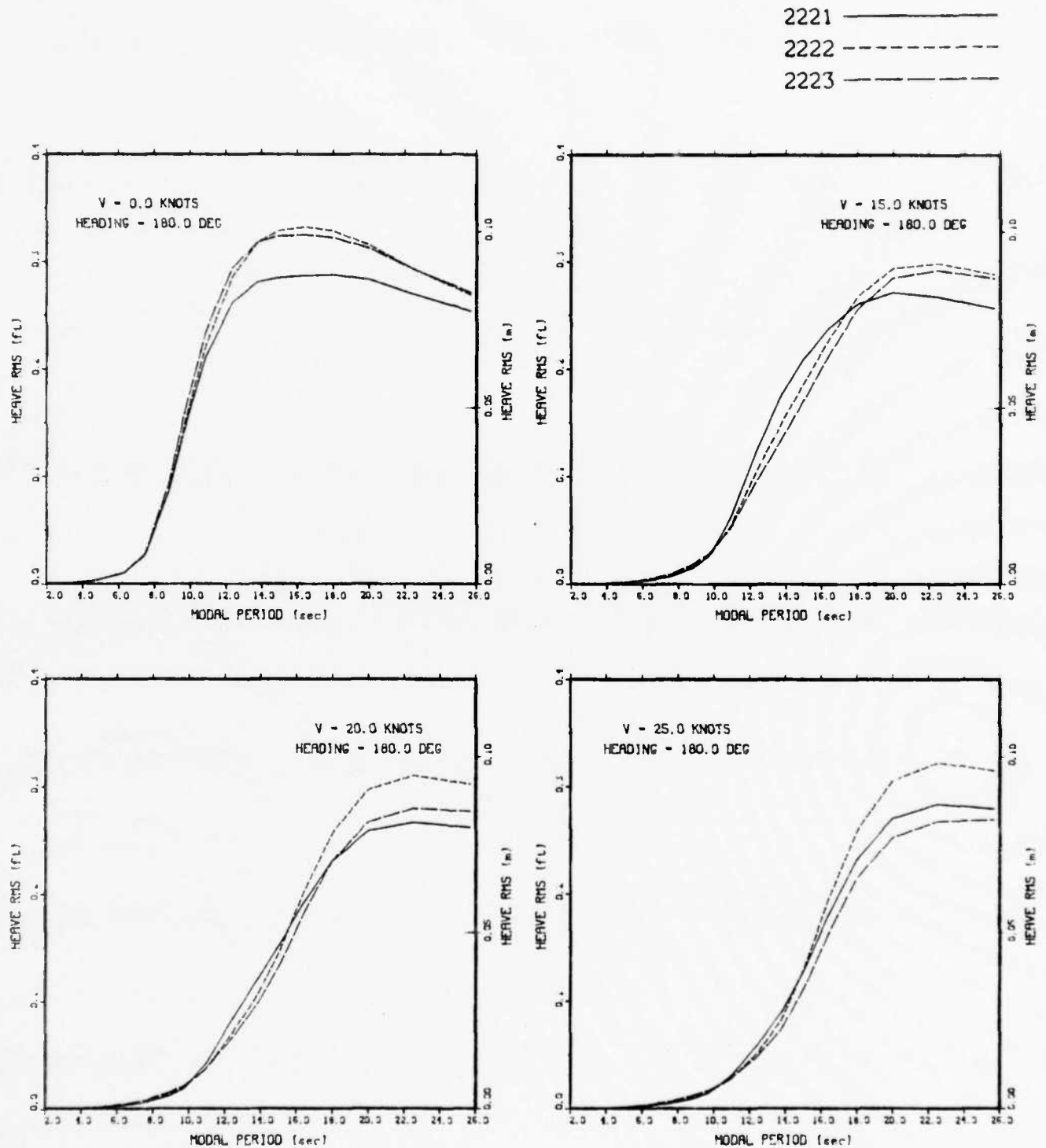


Figure 2n - Responses for Configurations 2221, 2222, and 2223

FIGURE 2 - CONTINUED

2231 —————
 2232 - - - - -
 2233 ————

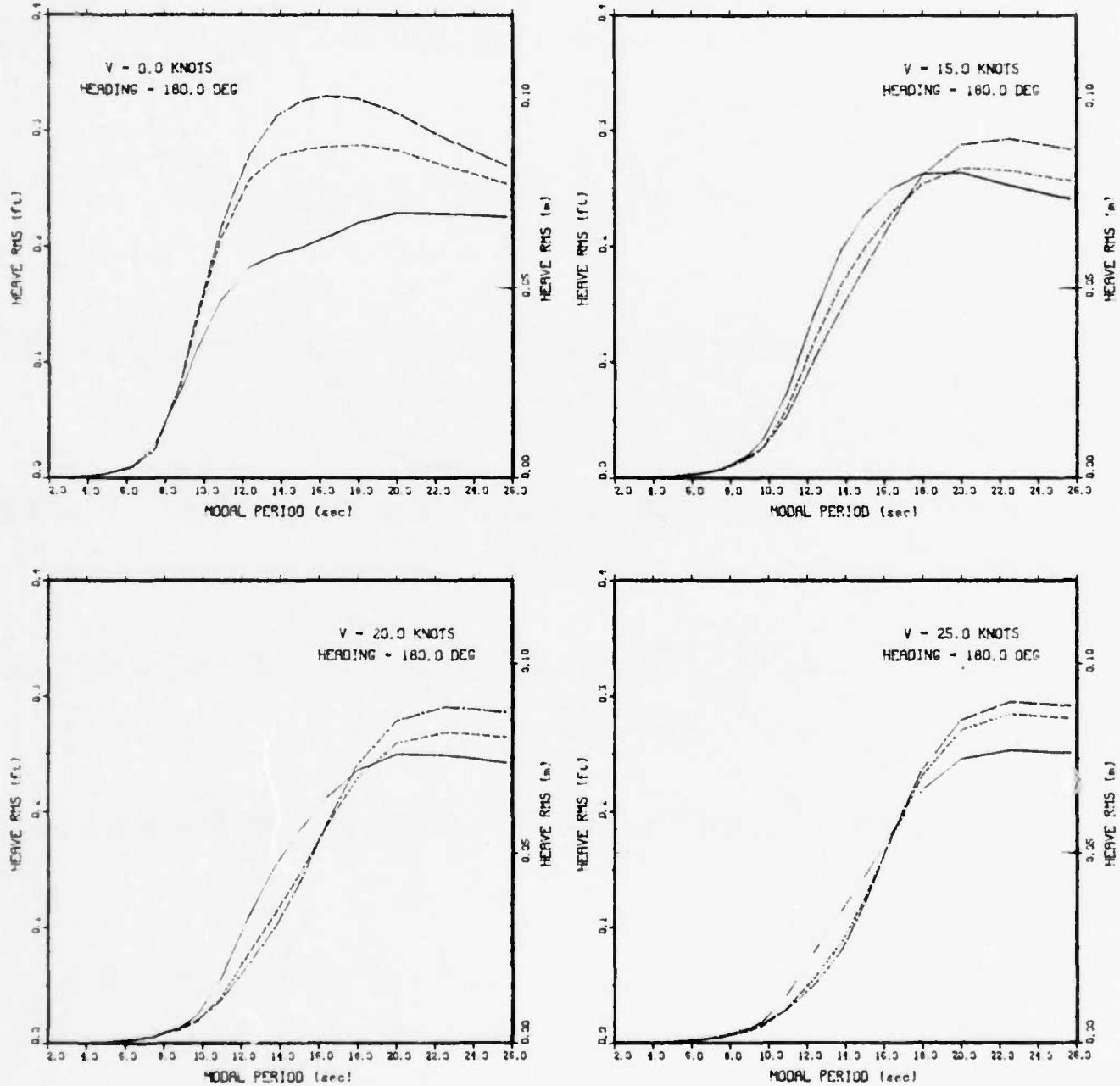


Figure 2c - Responses for Configurations 2231, 2232, and 2233

FIGURE 2 - CONTINUED

2311 —————
 2312 - - - - -
 2313 ————

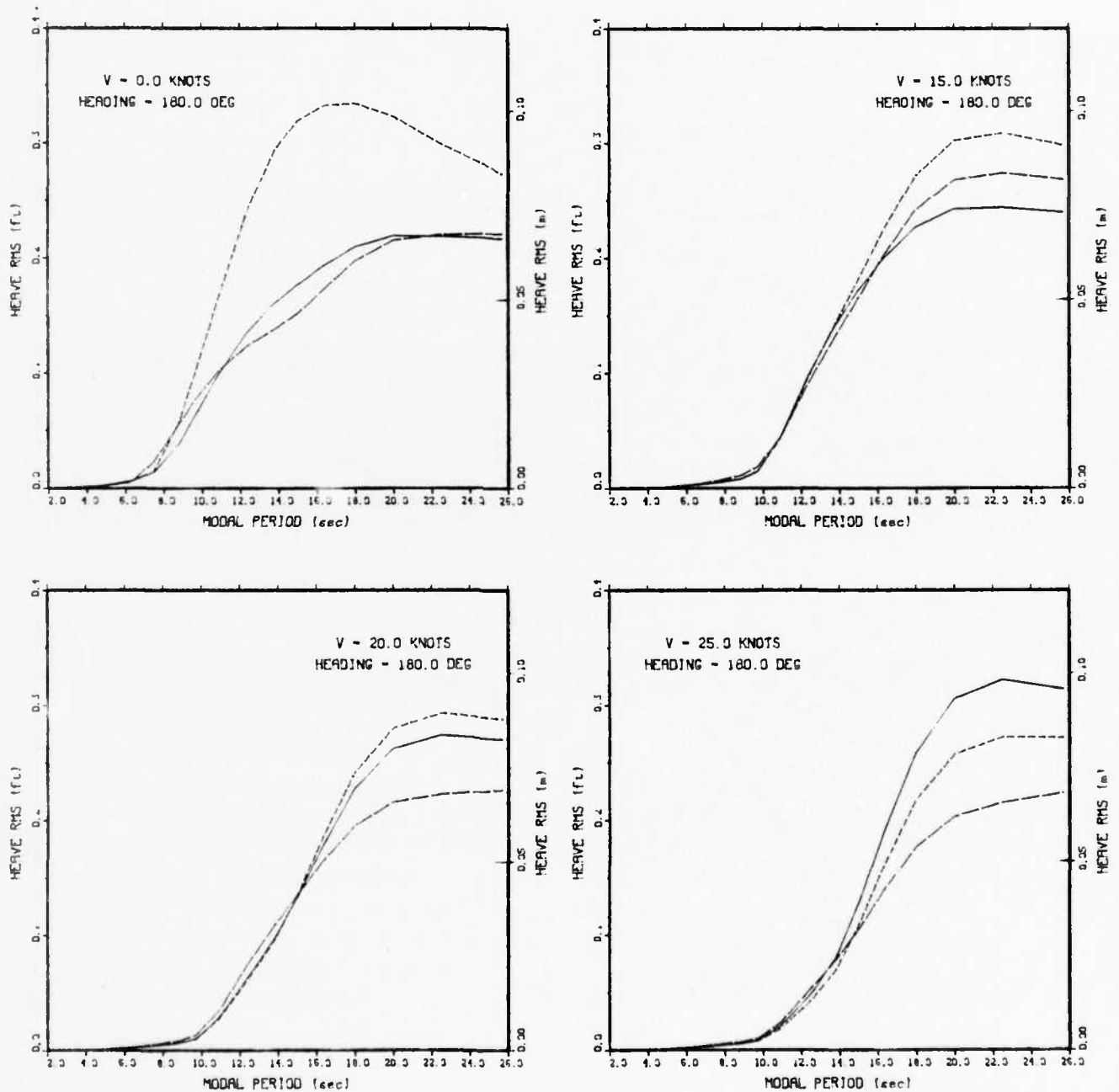


Figure 2p - Responses for Configurations 2311, 2312, and 2313

FIGURE 2 - CONTINUED

2321 —————
 2322 - - - - -
 2323 ————

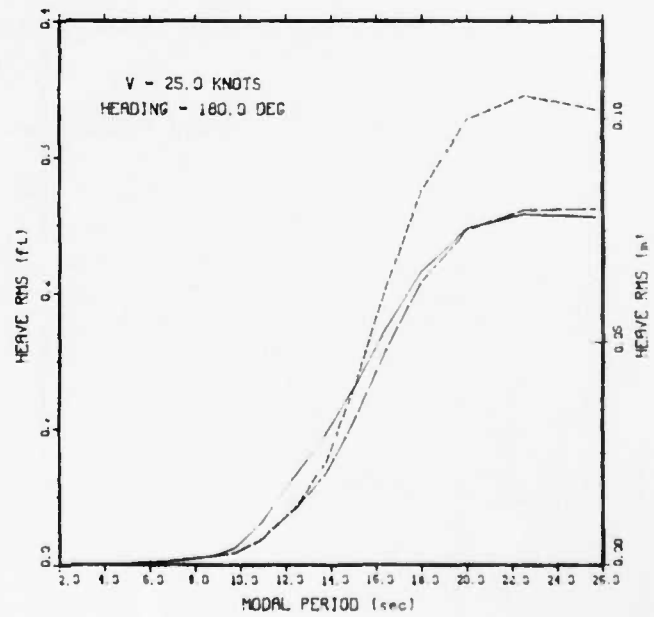
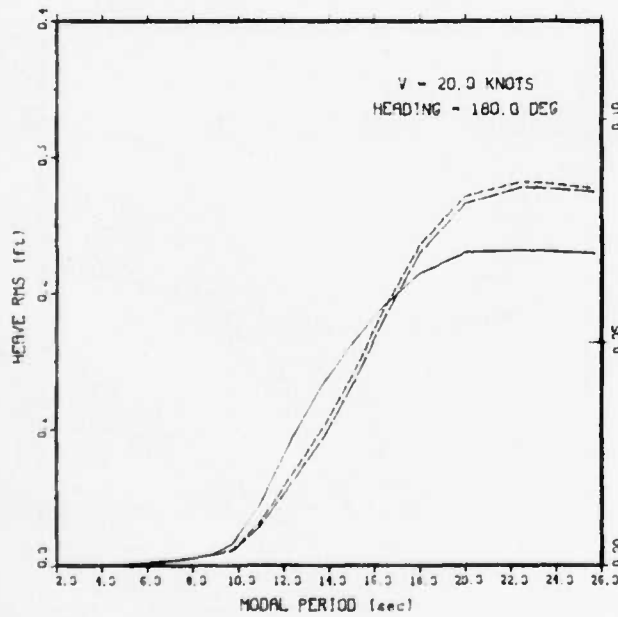
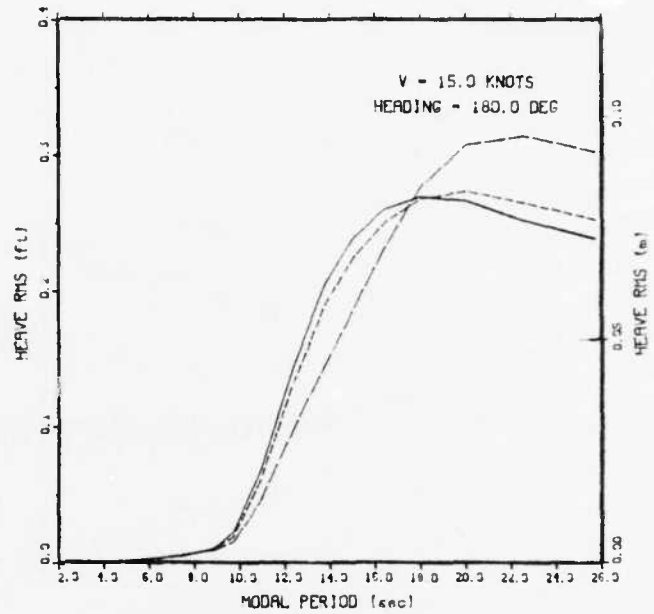
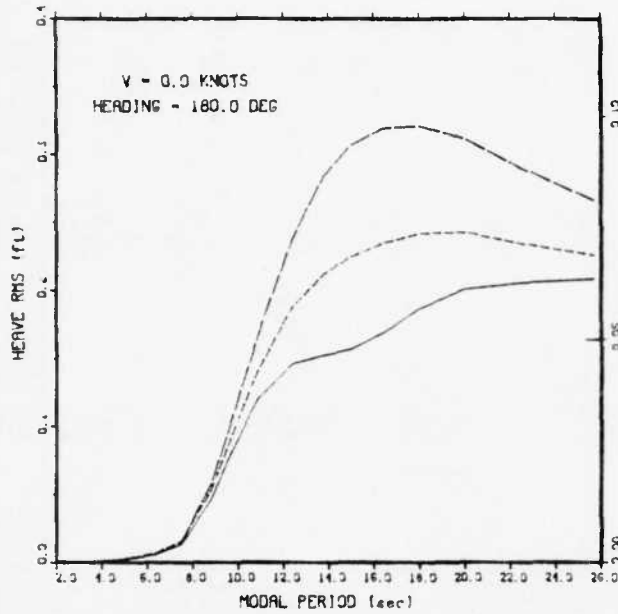


Figure 2q - Responses for Configurations 2321, 2322, and 2323

FIGURE 2 - CONTINUED

2331 —————
 2332 - - - - -
 2333 ————

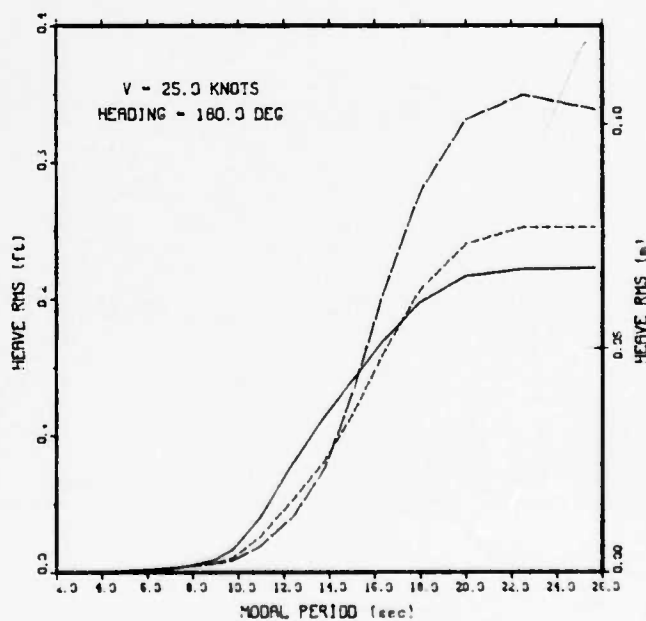
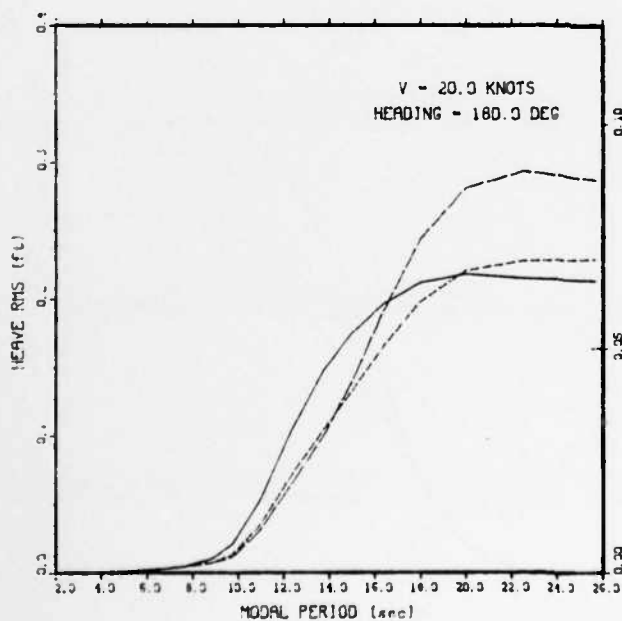
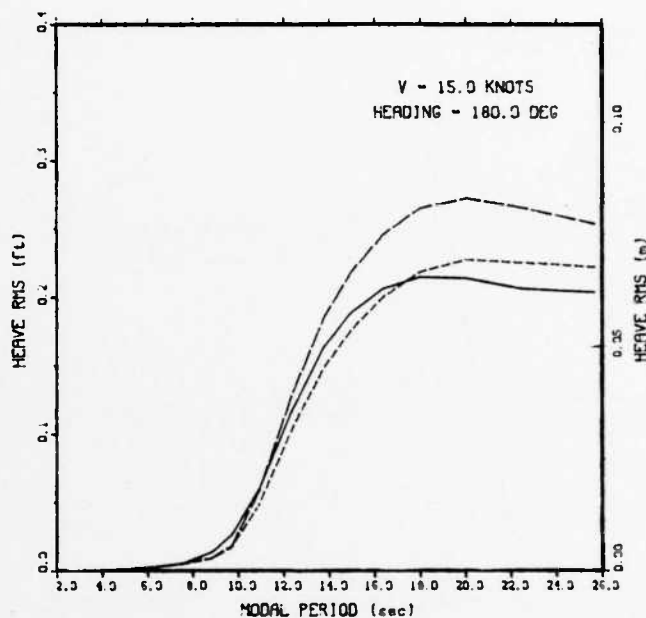
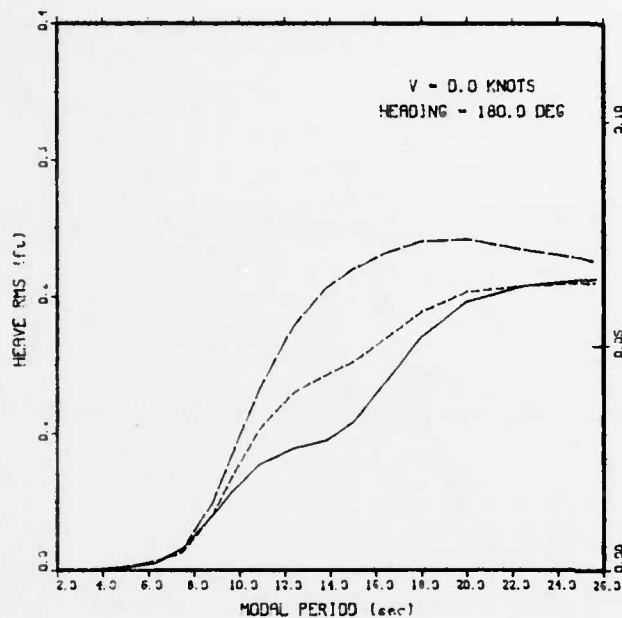


Figure 2r - Responses for Configurations 2331, 2332, and 2333

FIGURE 2 - CONTINUED

3111 —————
 3112 - - - - -
 3113 - - - - -

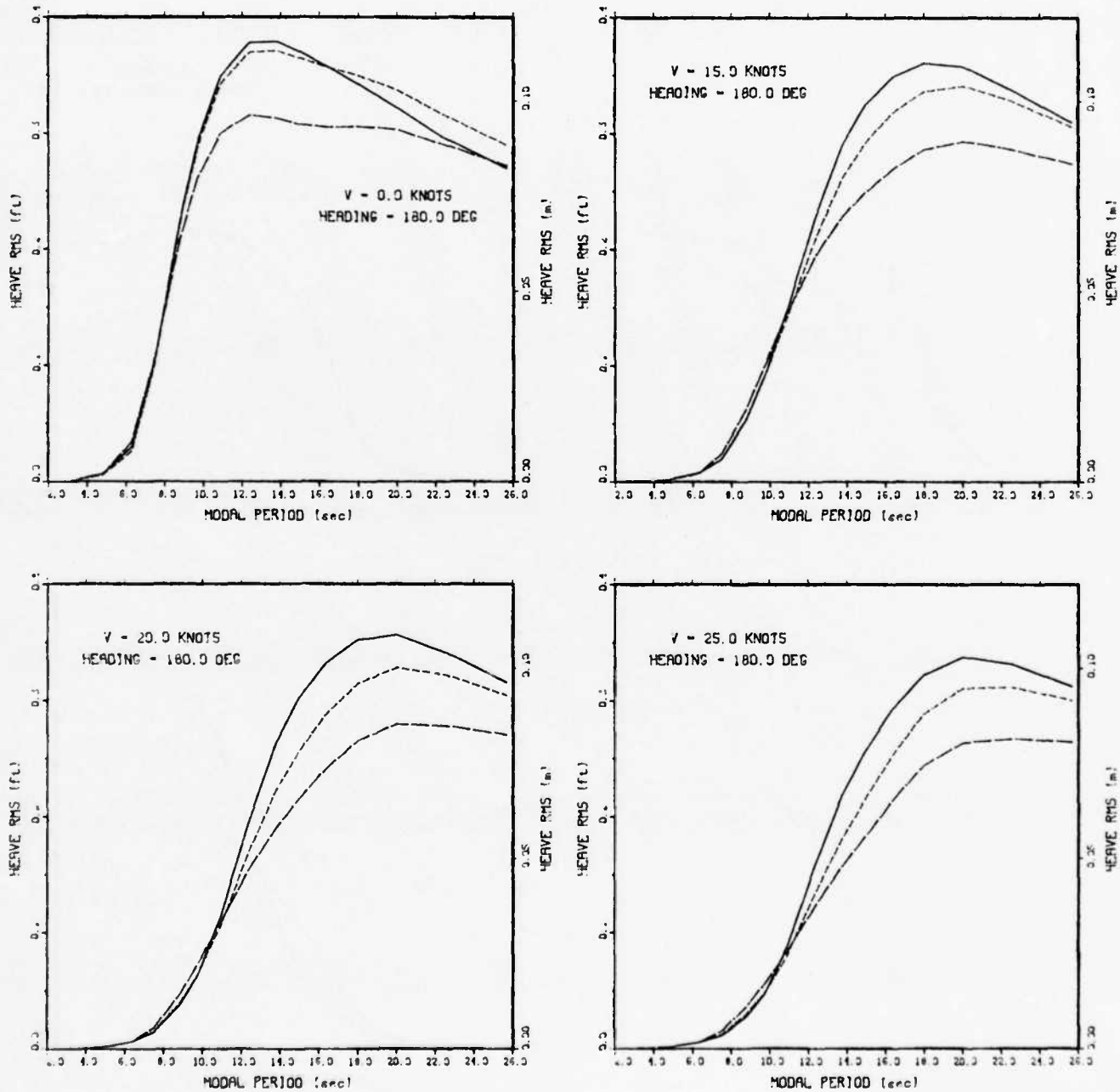


Figure 2s - Responses for Configurations 3111, 3112, and 3113

FIGURE 2 - CONTINUED

3121 —————
 3122 - - - - -
 3123 - - - - -

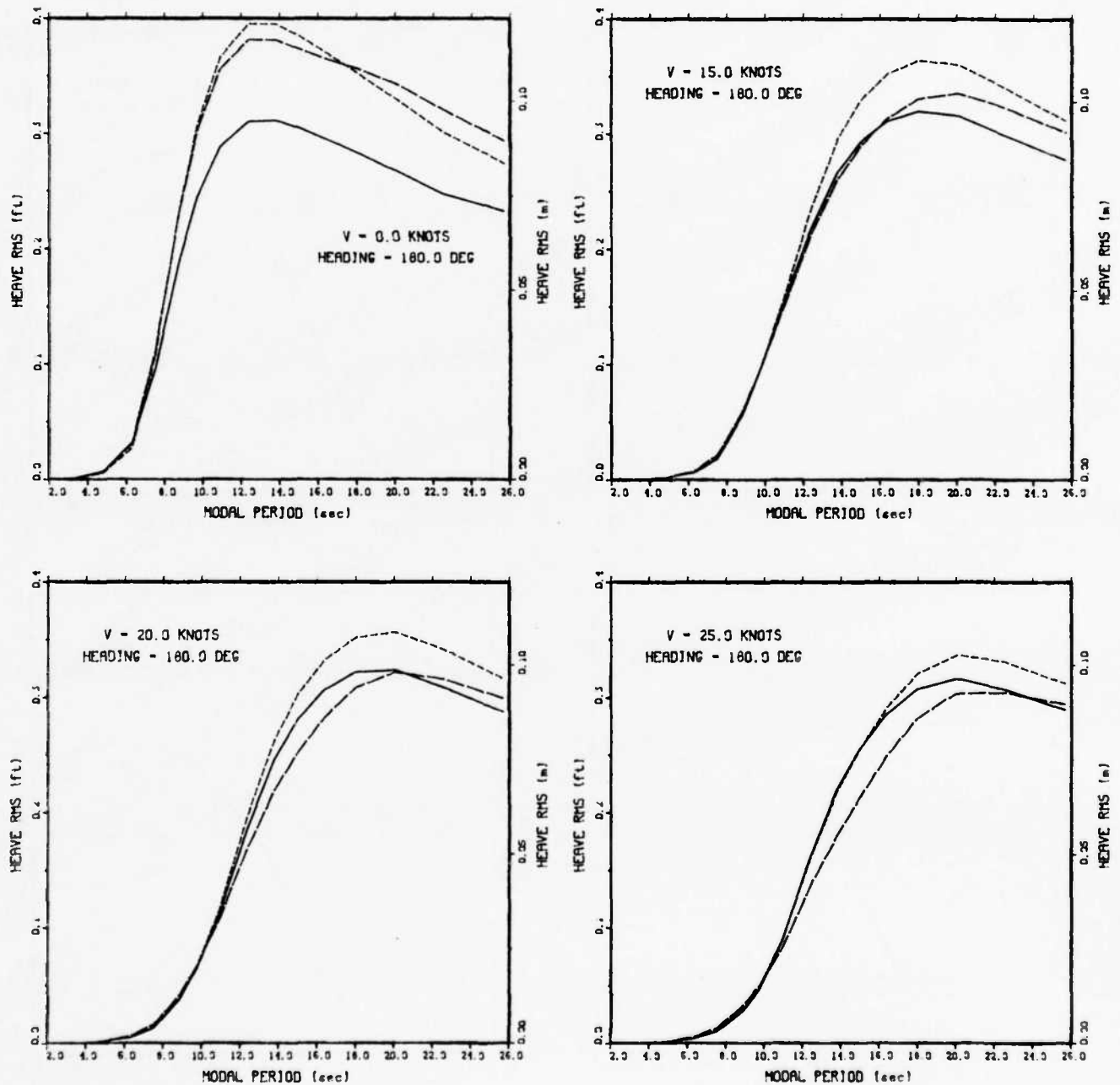


Figure 2t - Responses for Configurations 3121, 3122, and 3123

FIGURE 2 - CONTINUED

3132 -----
3133 —————

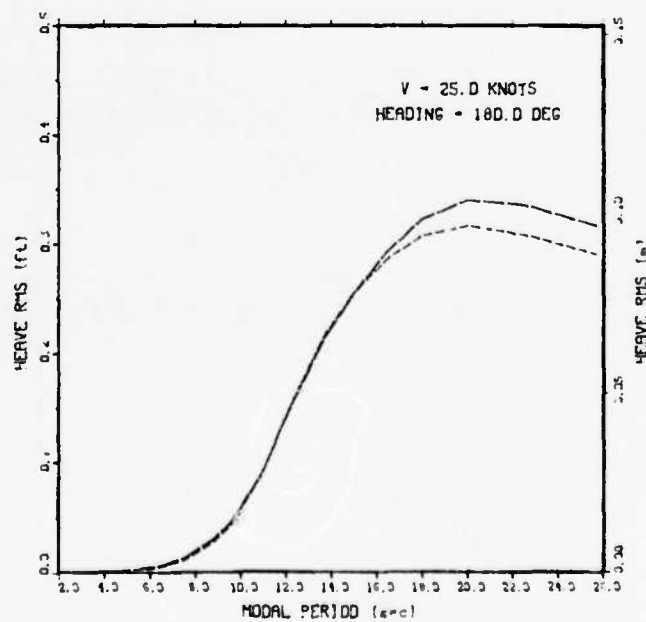
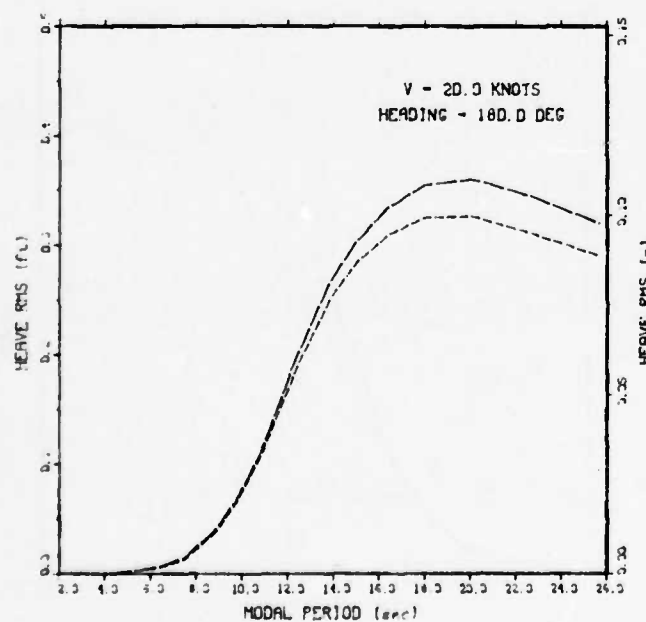
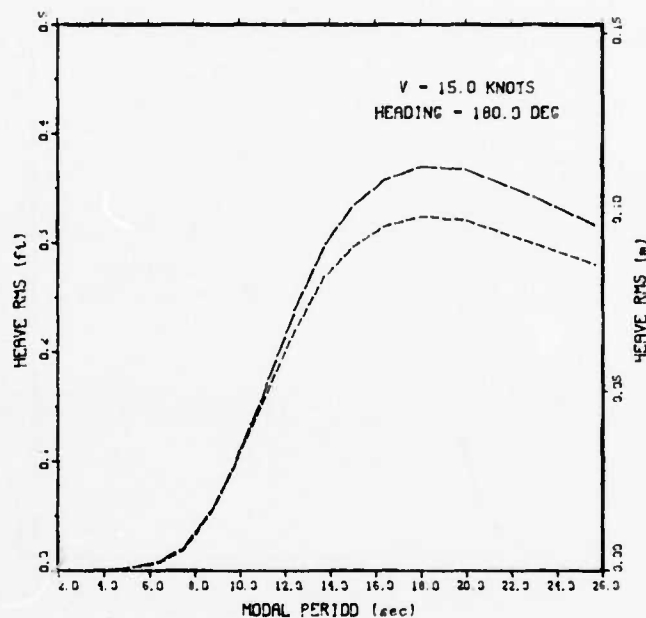
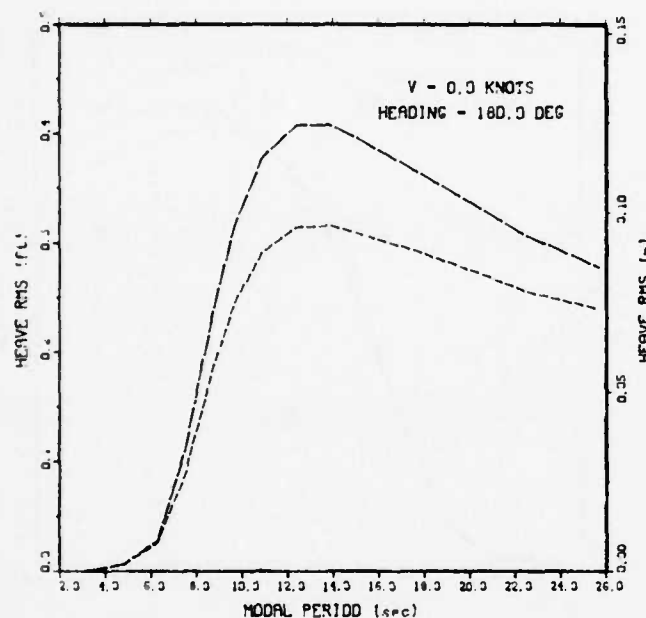


Figure 2u - Responses for Configurations 3132 and 3133

FIGURE 2 - CONTINUED

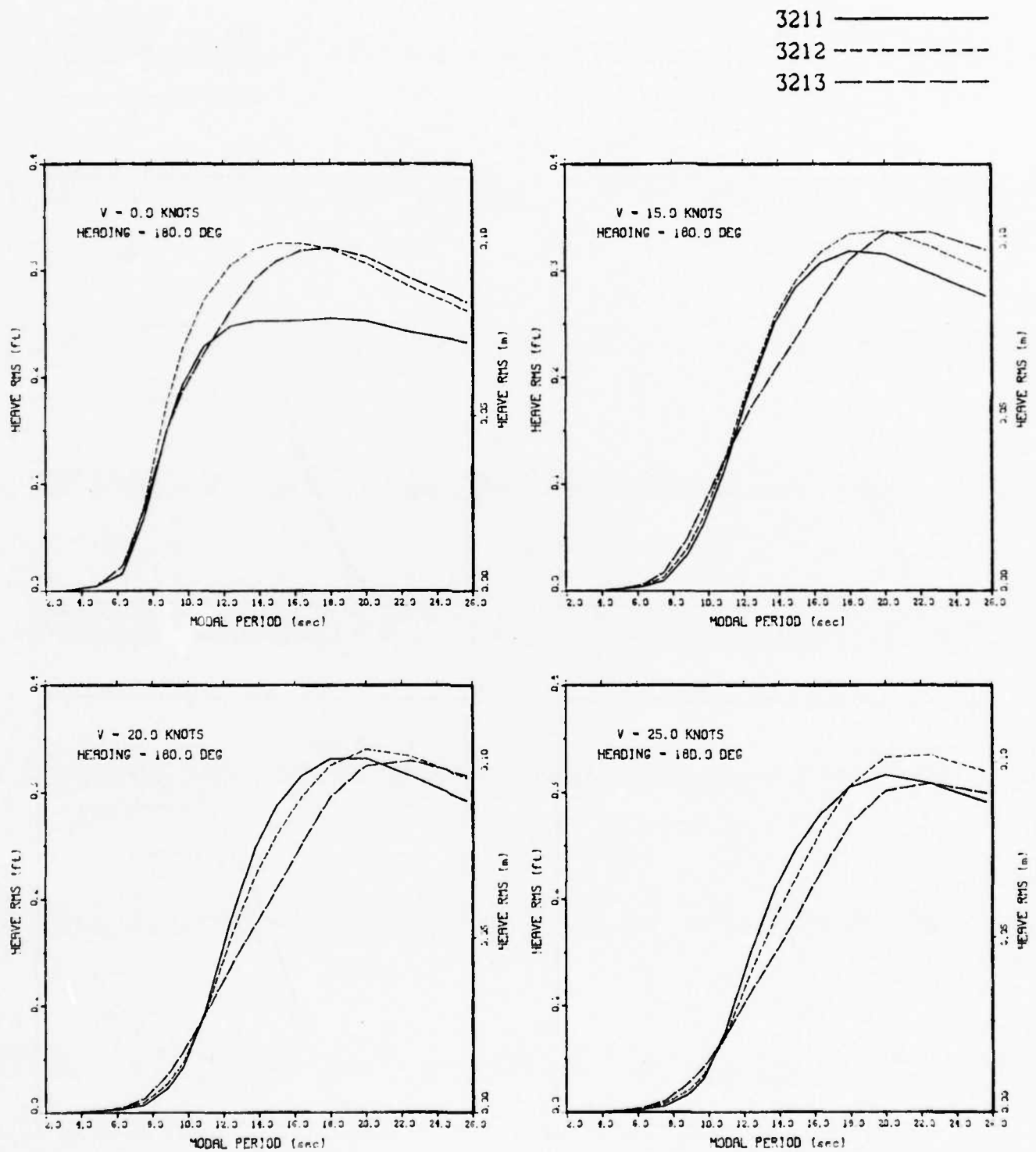


Figure 2v - Responses for Configurations 3211, 3212, and 3213

FIGURE 2 - CONTINUED

3221 —————
 3222 - - - - -
 3223 - - - - -

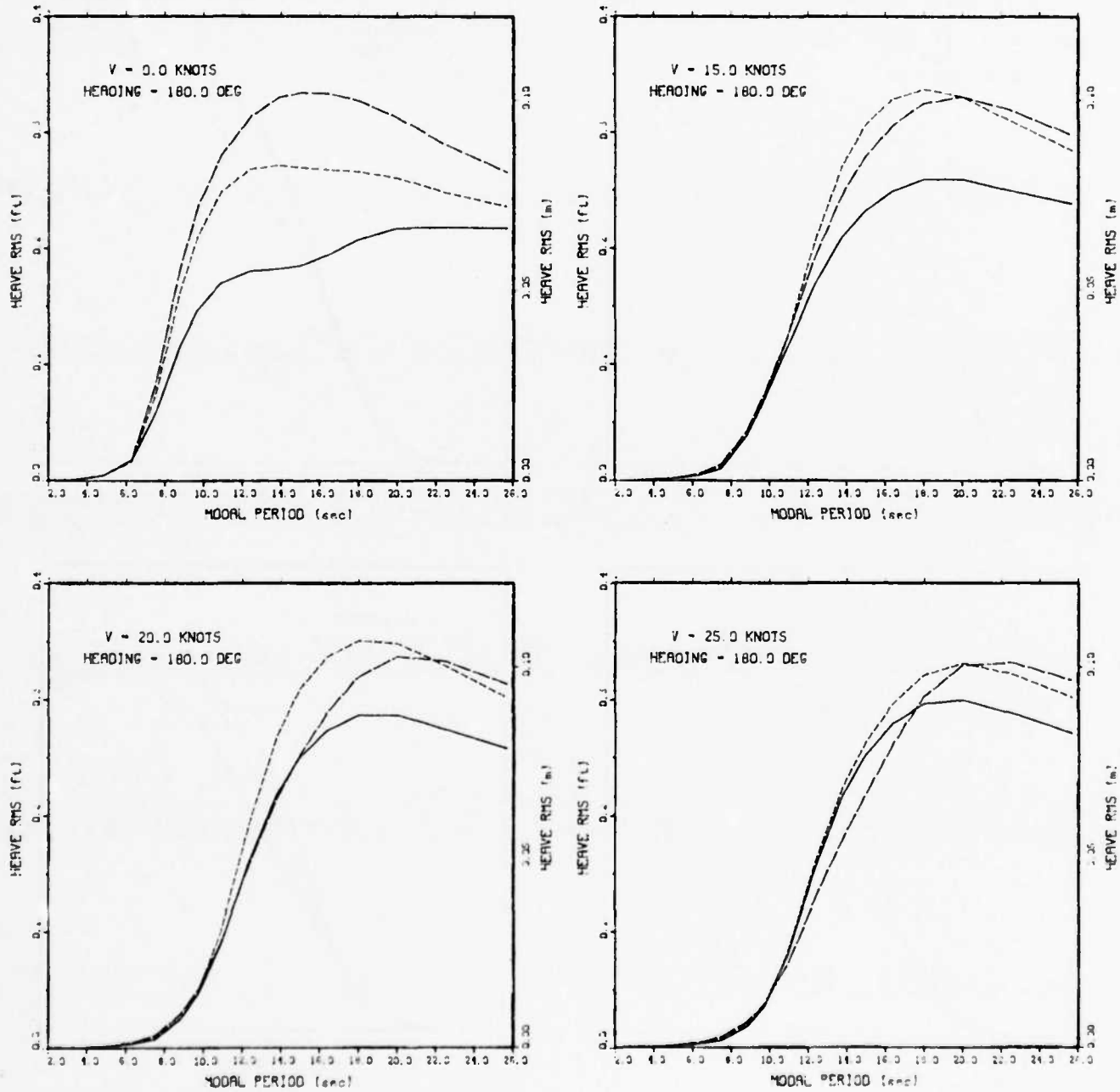


Figure 2w - Responses for Configurations 3221, 3222, and 3223

FIGURE 2 - CONTINUED

3231 —————
 3232 - - - - -
 3233 —————

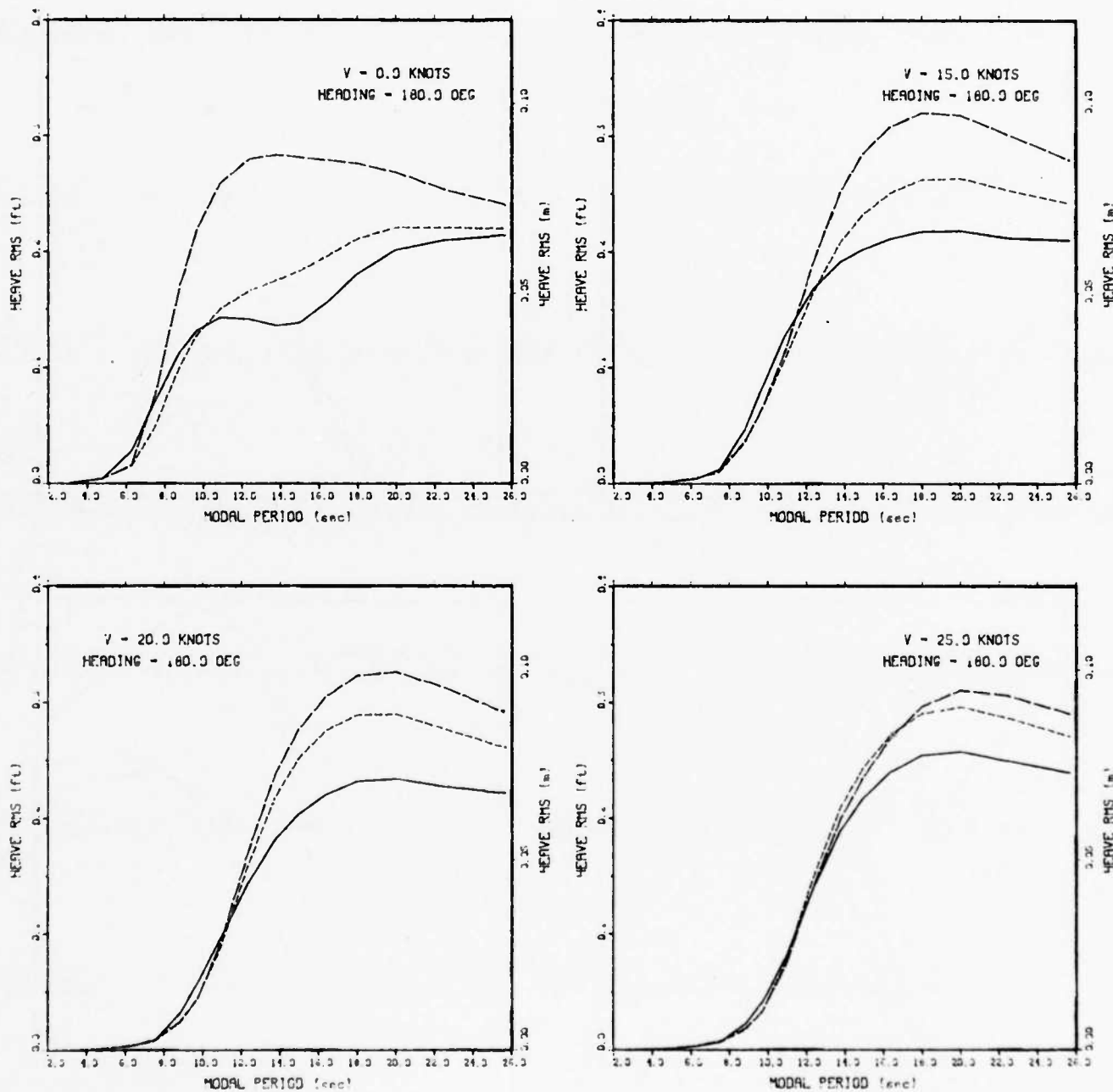


Figure 2x - Responses for Configurations 3231, 3232, and 3233

FIGURE 2 - CONTINUED

3311 —————
 3312 - - - - -
 3313 —————

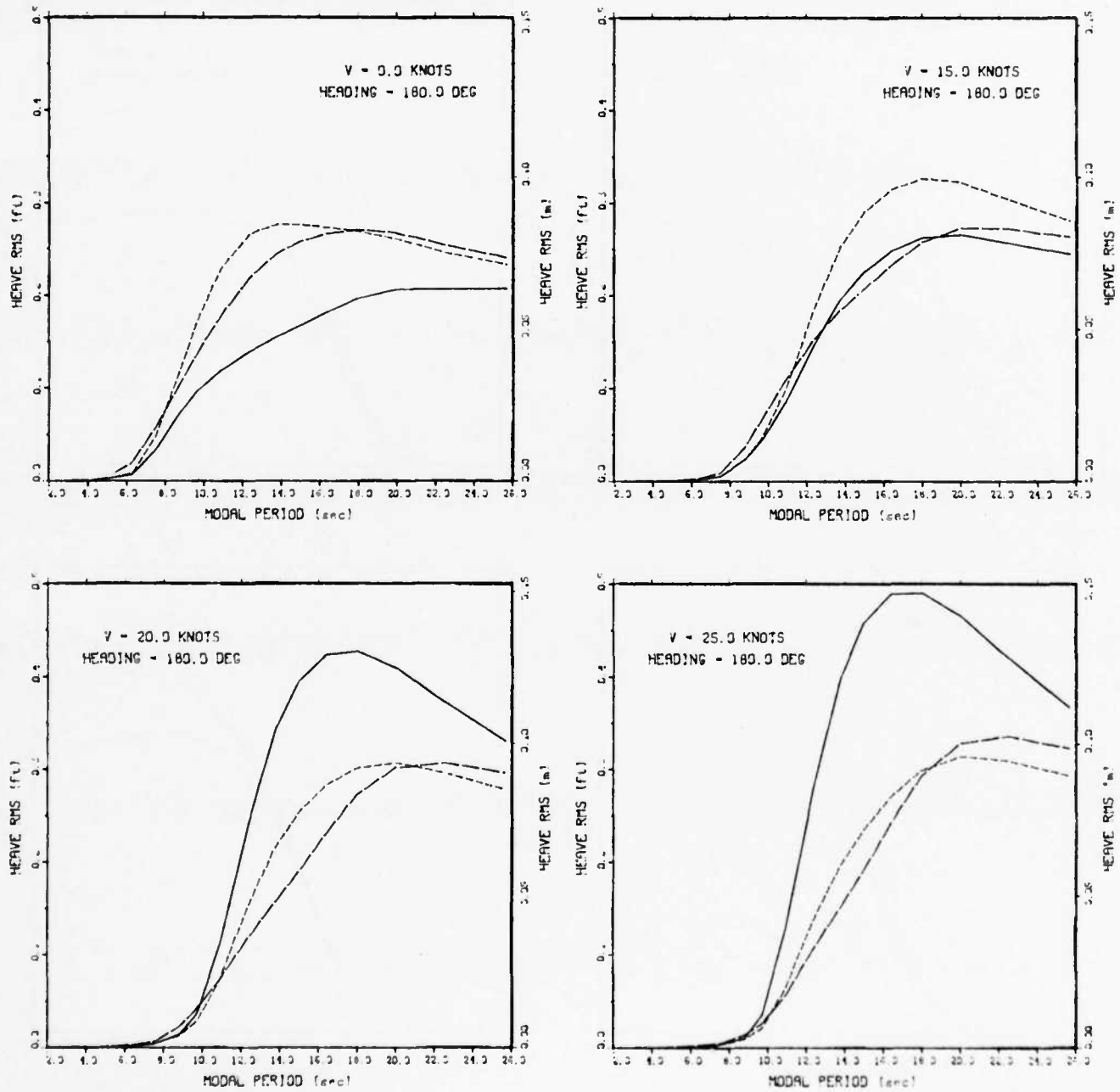


Figure 2y - Responses for Configurations 3311, 3312, and 3313

FIGURE 2 - CONTINUED

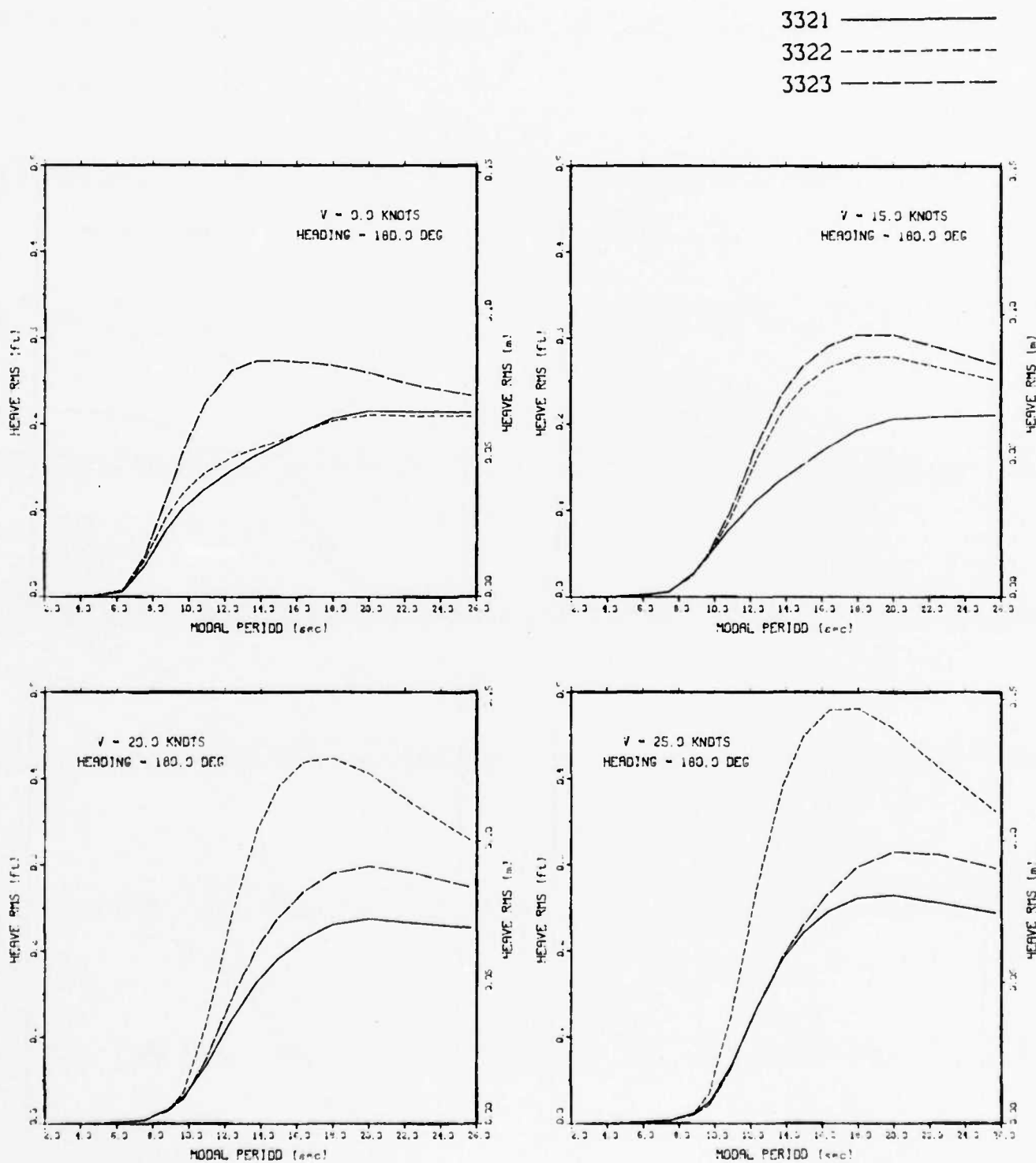


Figure 2z - Responses for Configurations 3321, 3322, and 3323

FIGURE 2 - CONTINUED

3331 —————
 3332 - - - - -
 3333 - - - - -

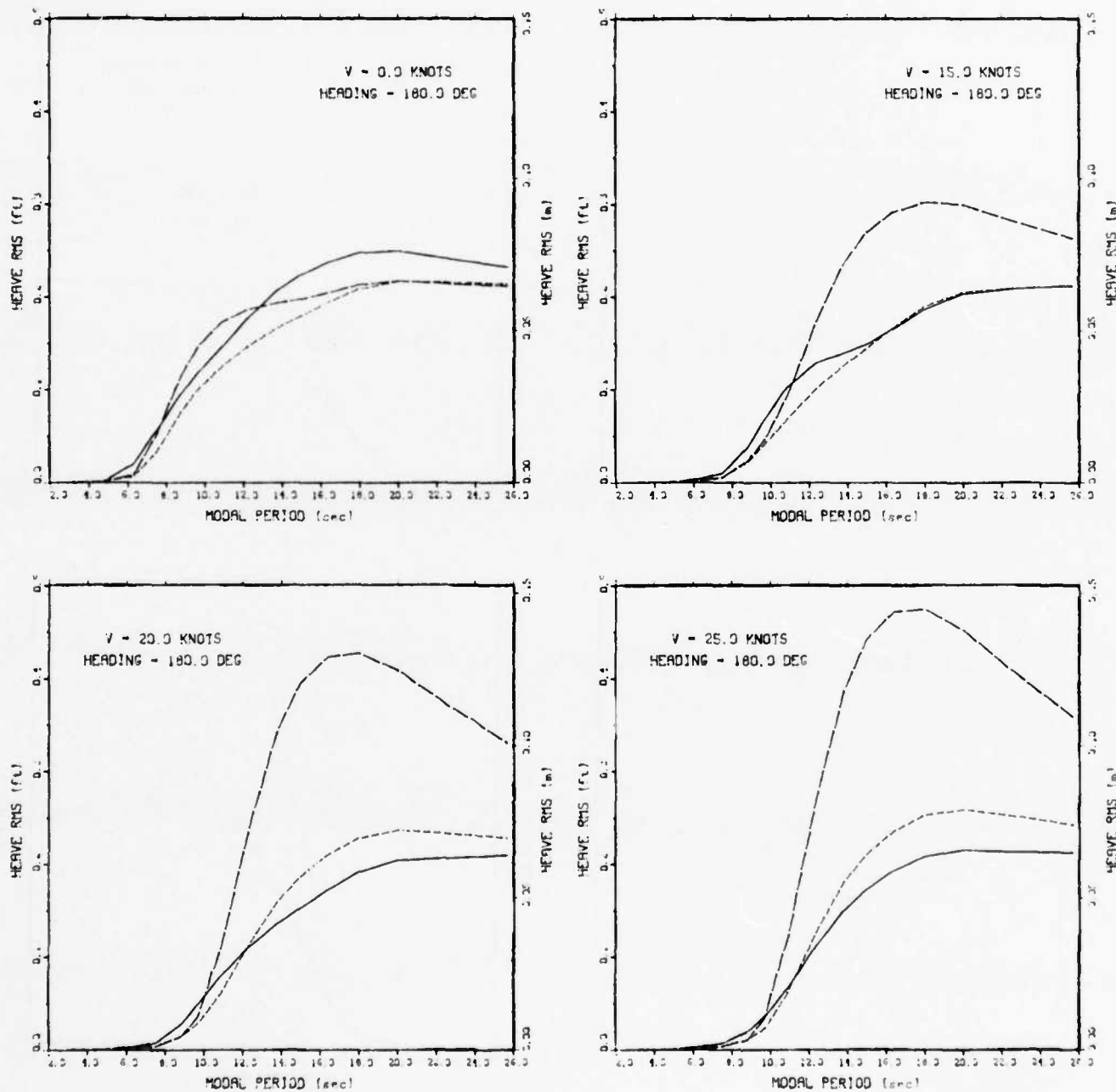


Figure 2aa - Responses for Configurations 3331, 3332, and 3333

FIGURE 3 - PITCH RMS RESPONSES IN HEAD SEAS

1111 —————
 1112 - - - - -
 1113 ————

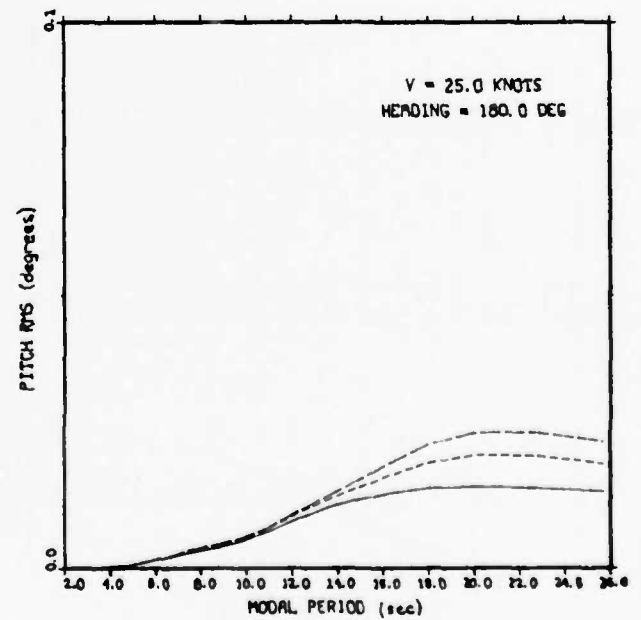
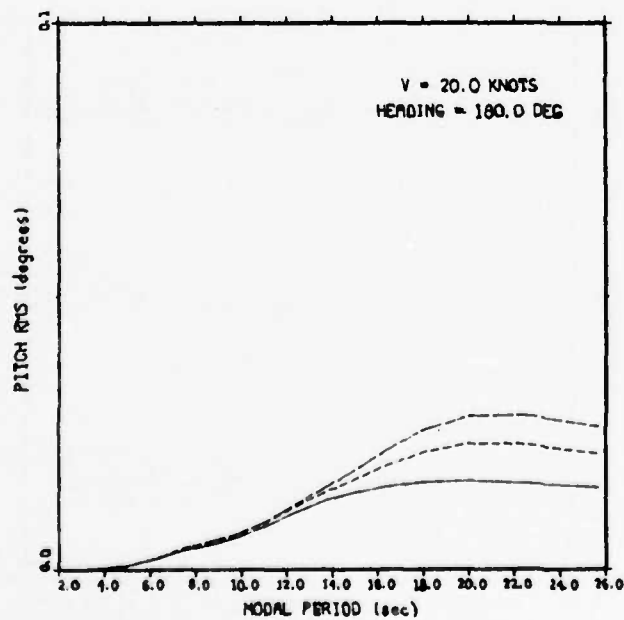
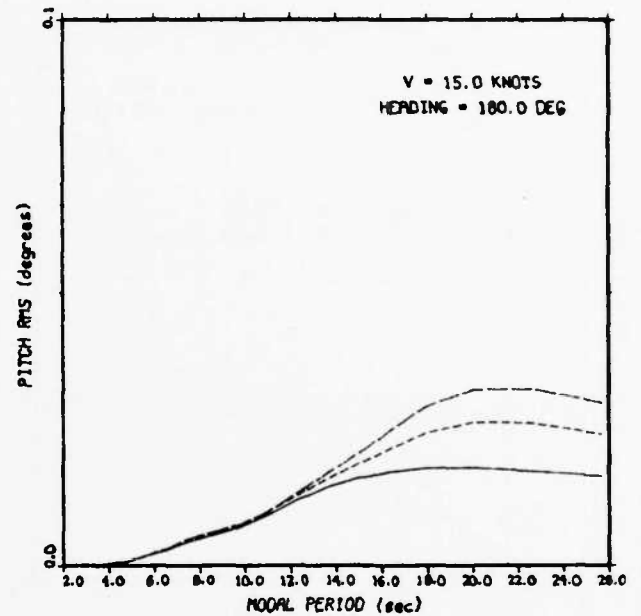
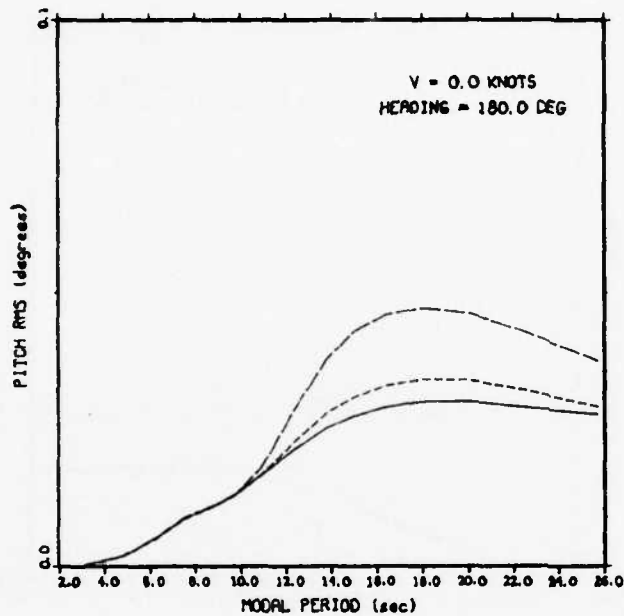


Figure 3a - Responses for Configurations 1111, 1112, and 1113

FIGURE 3 - CONTINUED

1121 —————
 1122 - - - - -
 1123 — · — · —

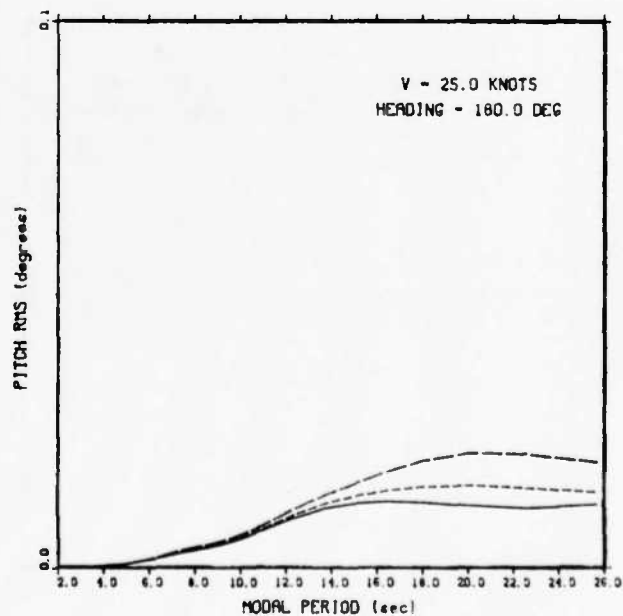
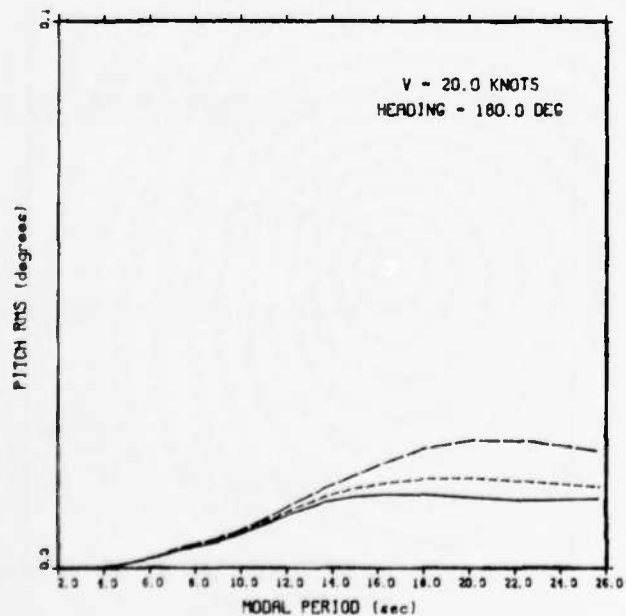
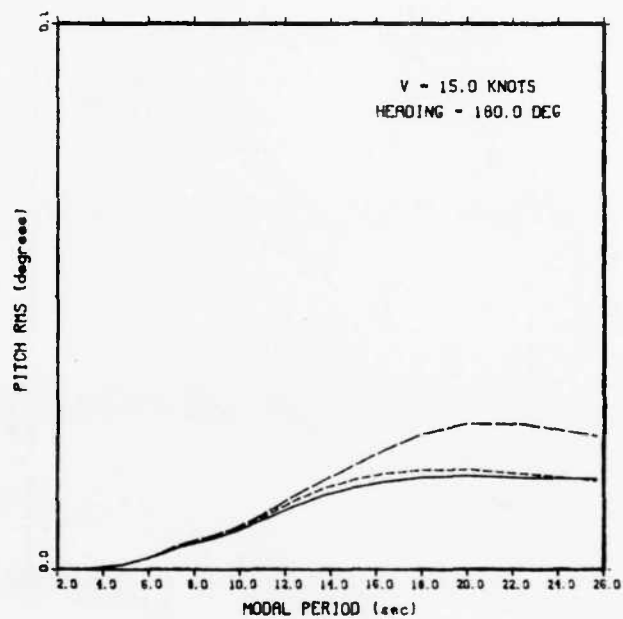
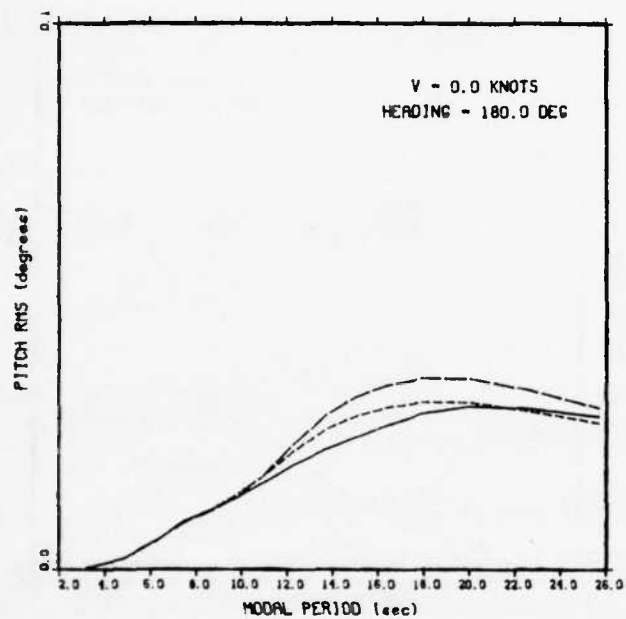


Figure 3b - Responses for Configurations 1121, 1122, and 1123

FIGURE 3 - CONTINUED

1131 —————
 1132 - - - - -
 1133 ————

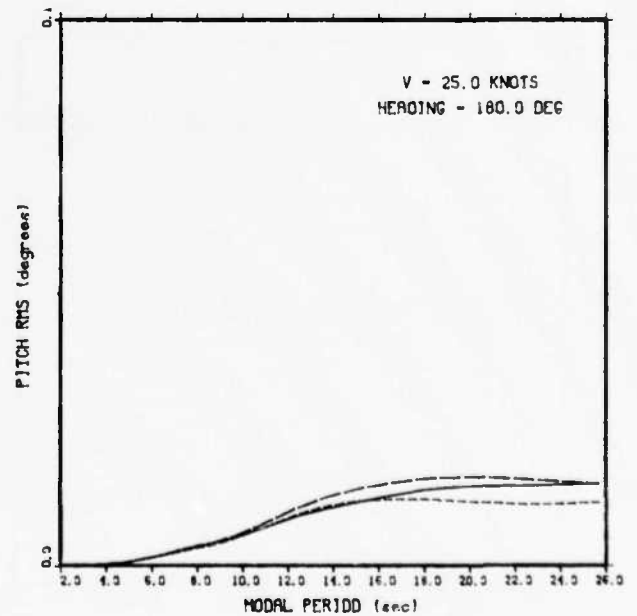
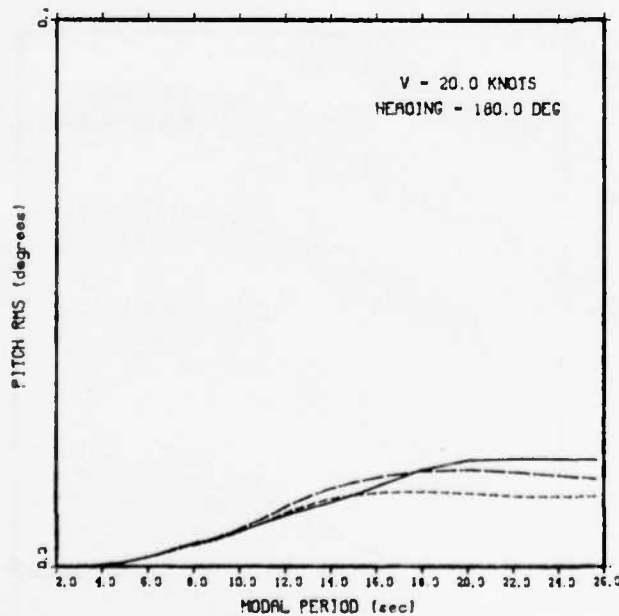
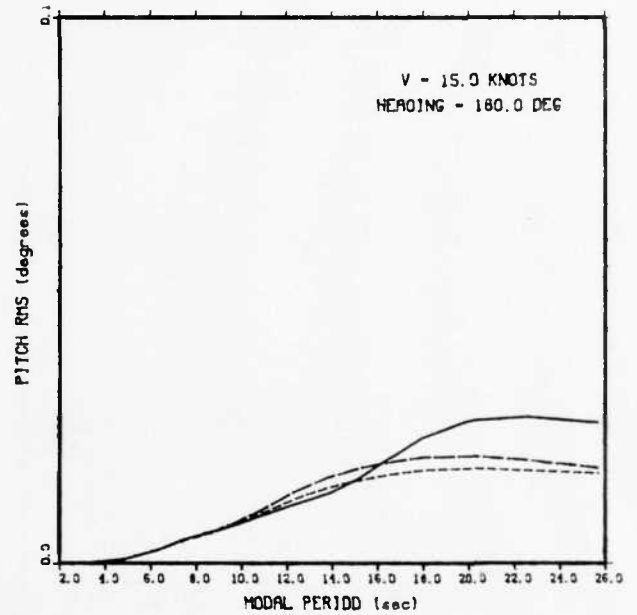
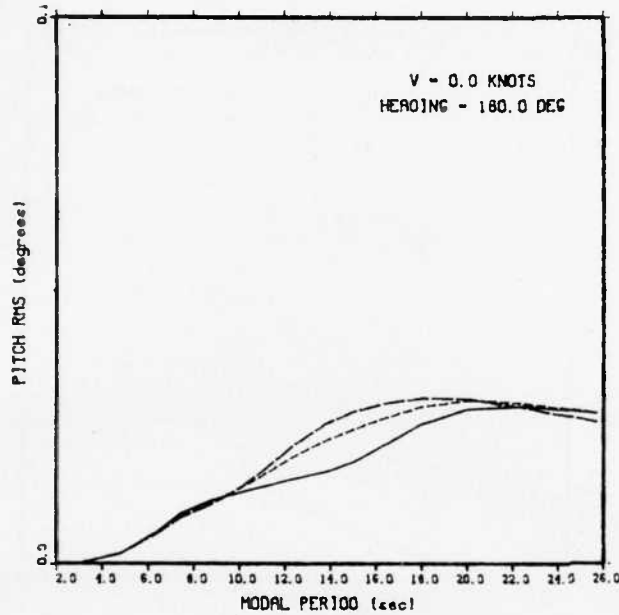


Figure 3c - Responses for Configurations 1131, 1132, and 1133

FIGURE 3 - CONTINUED

1211 —————
 1212 - - - - -
 1213 —————

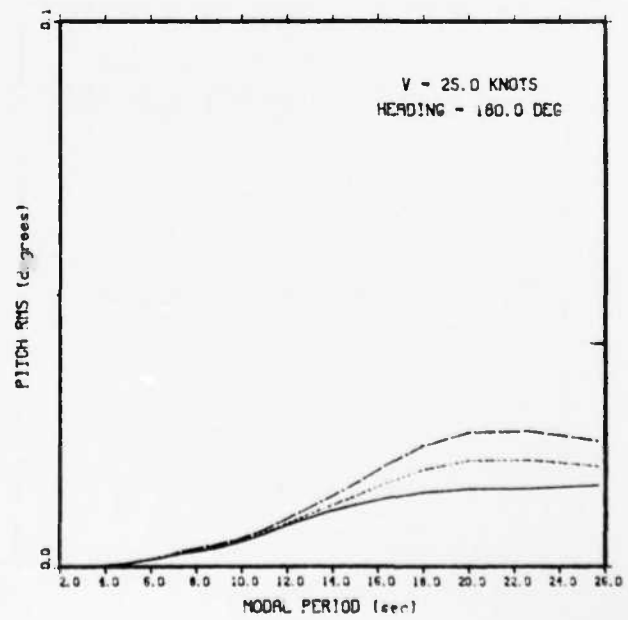
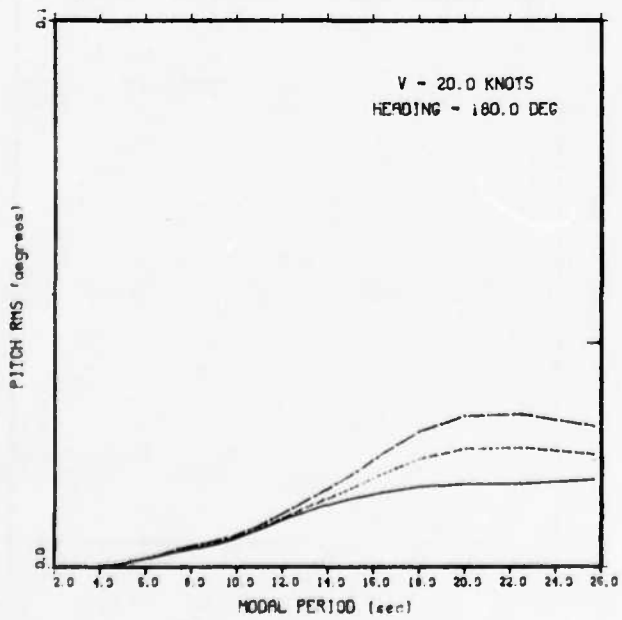
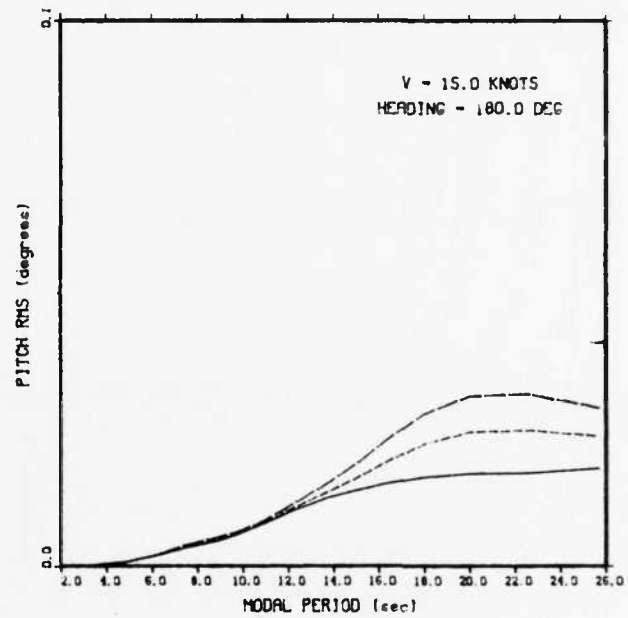
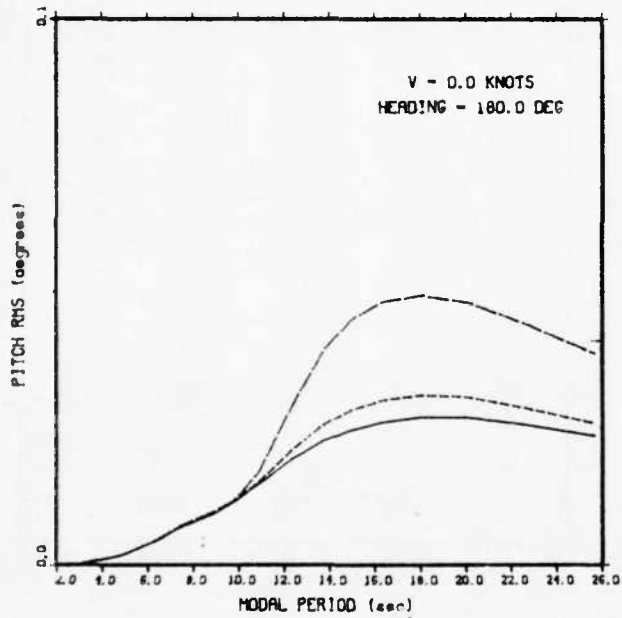


Figure 3d - Responses for Configurations 1211, 1212, and 1213

FIGURE 3 - CONTINUED

1221 —————
 1222 - - - - -
 1223 —————

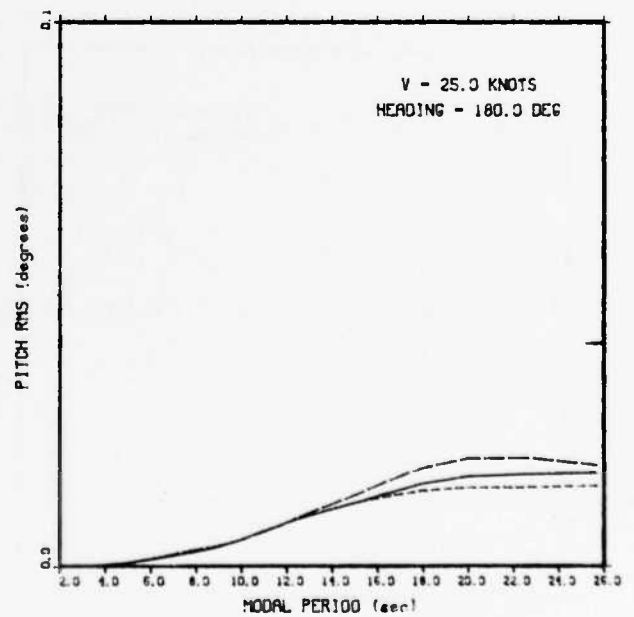
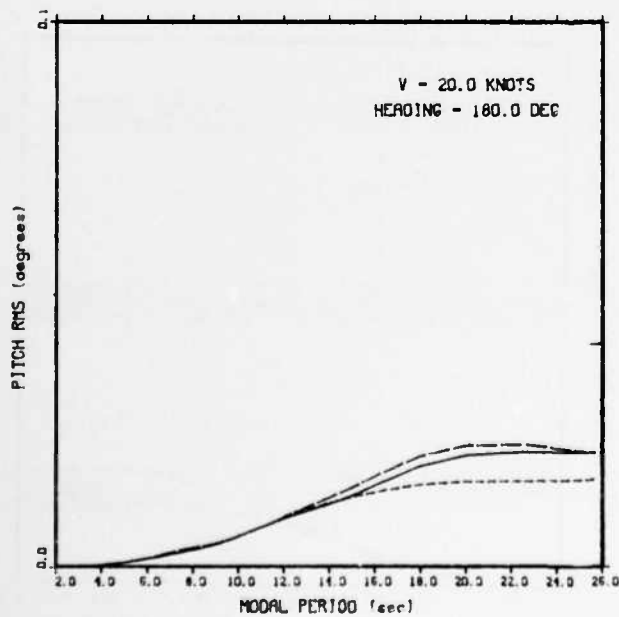
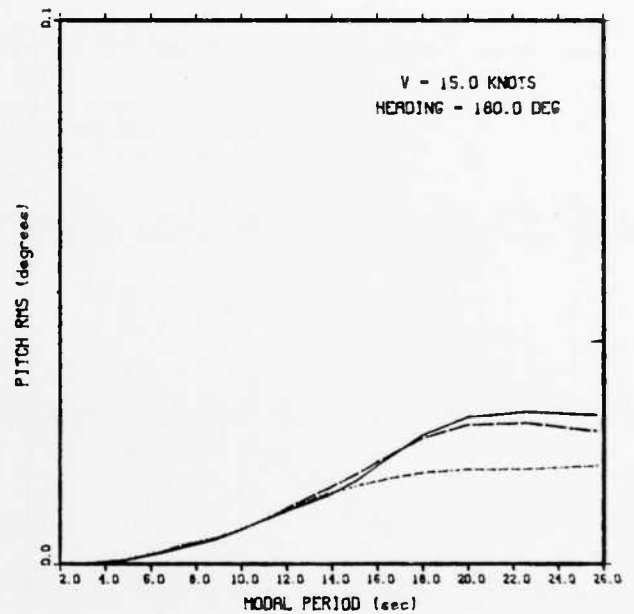
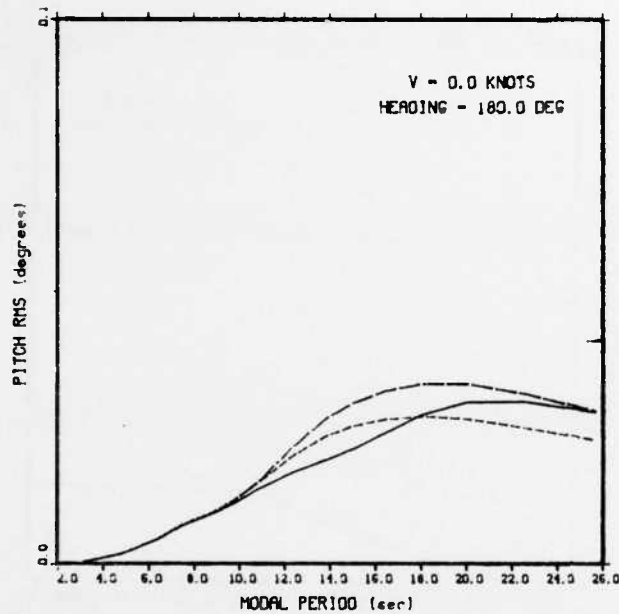


Figure 3e - Responses for Configurations 1221, 1222, and 1223

FIGURE 3 - CONTINUED

1231 —————
 1232 - - - - -
 1233 ————

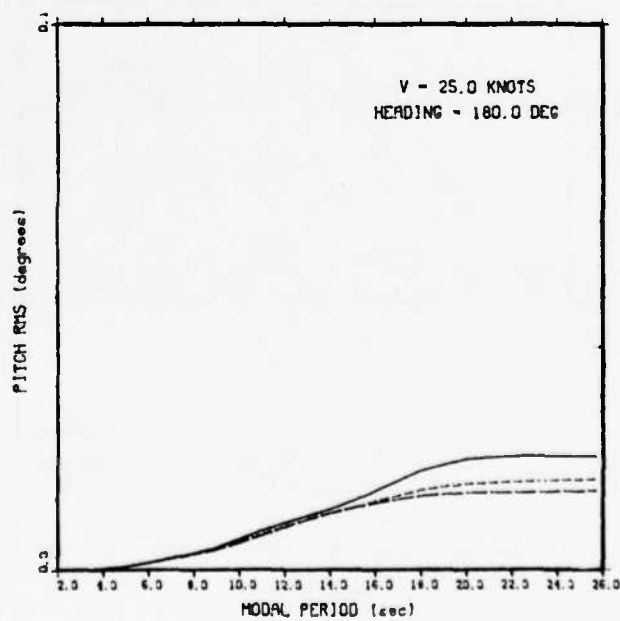
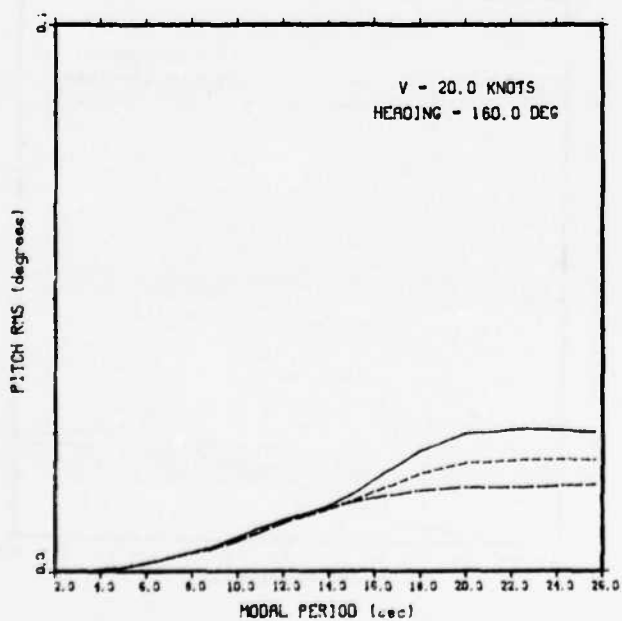
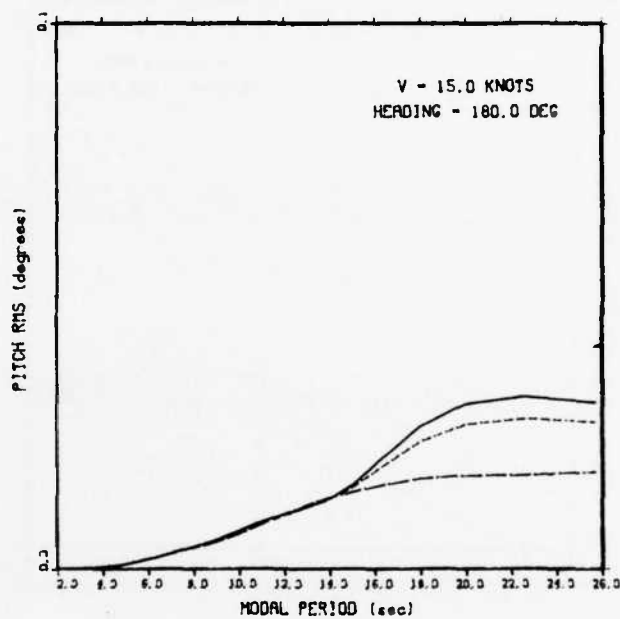
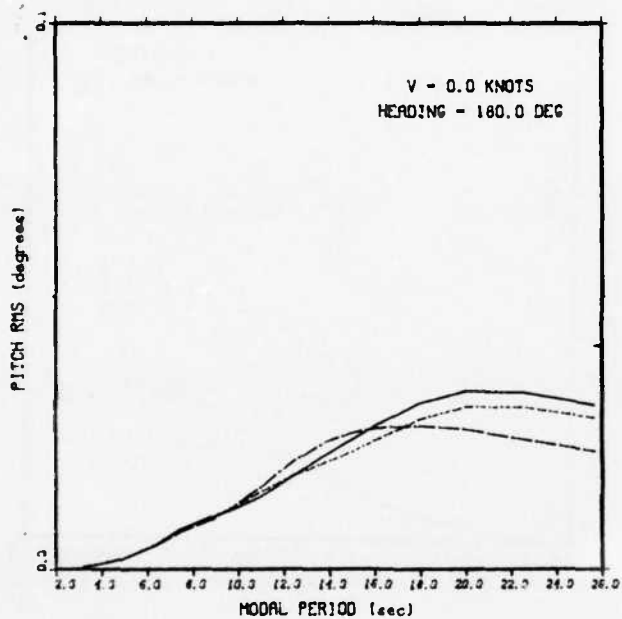


Figure 3f - Responses for Configurations 1231, 1232, and 1233

FIGURE 3 - CONTINUED

1311 —————
 1312 - - - - -
 1313 ————

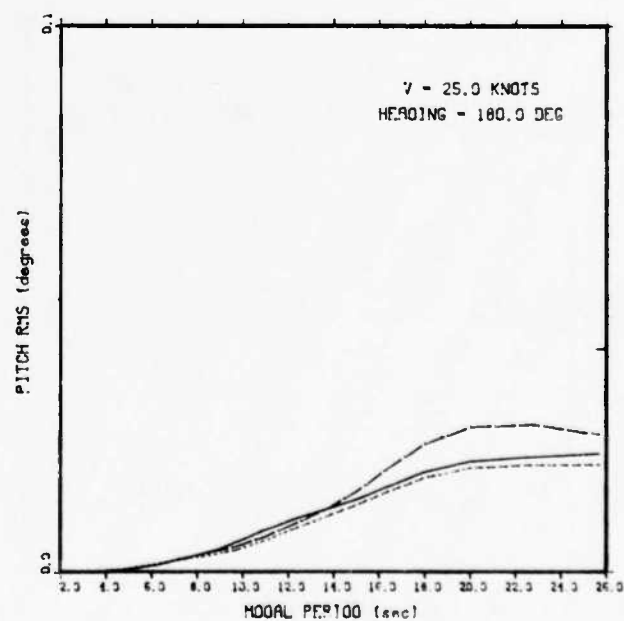
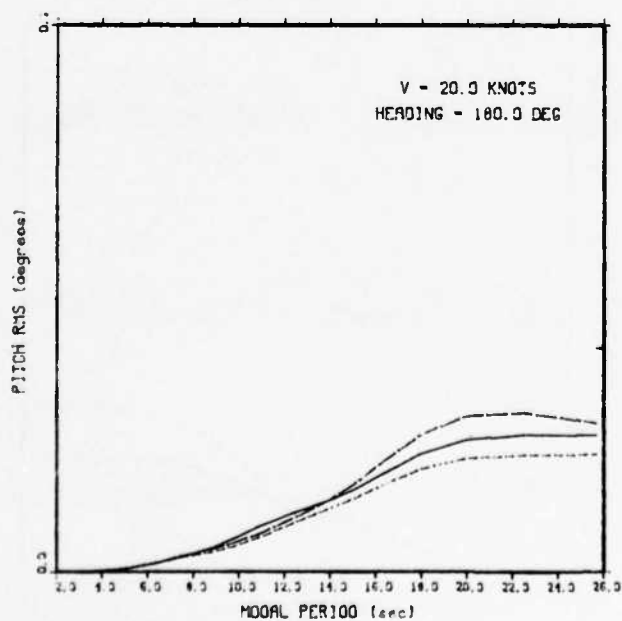
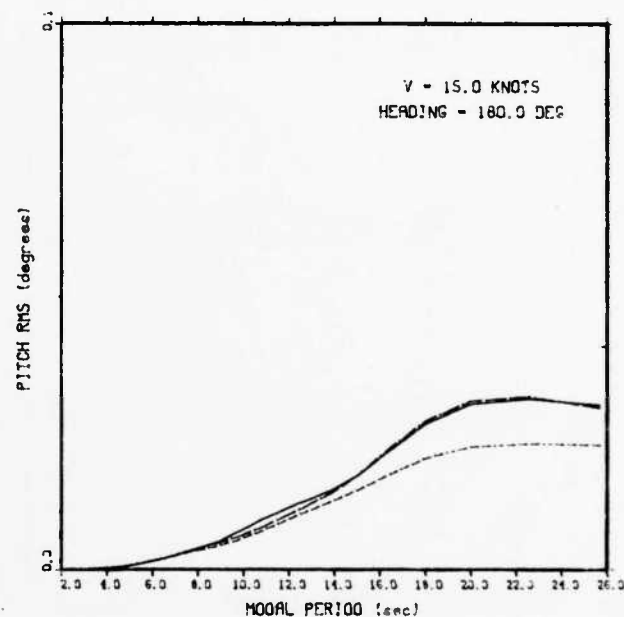
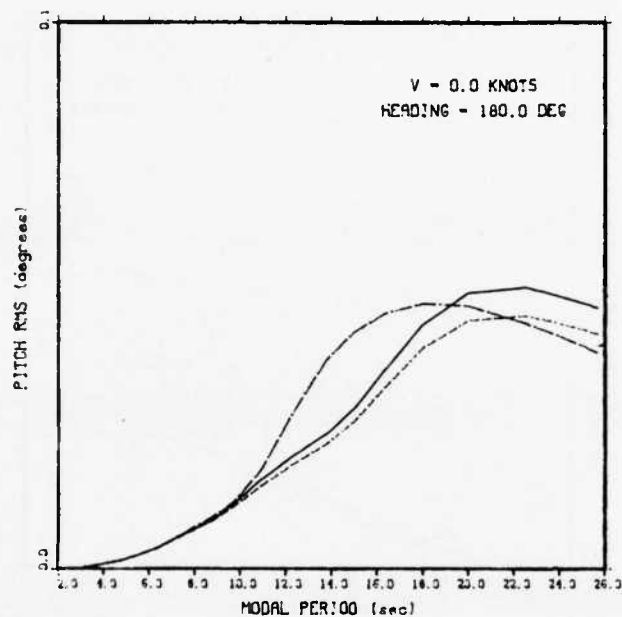


Figure 3g - Responses for Configurations 1311, 1312, and 1313

FIGURE 3 - CONTINUED

1321 —————
 1322 - - - - -
 1323 - - - - -

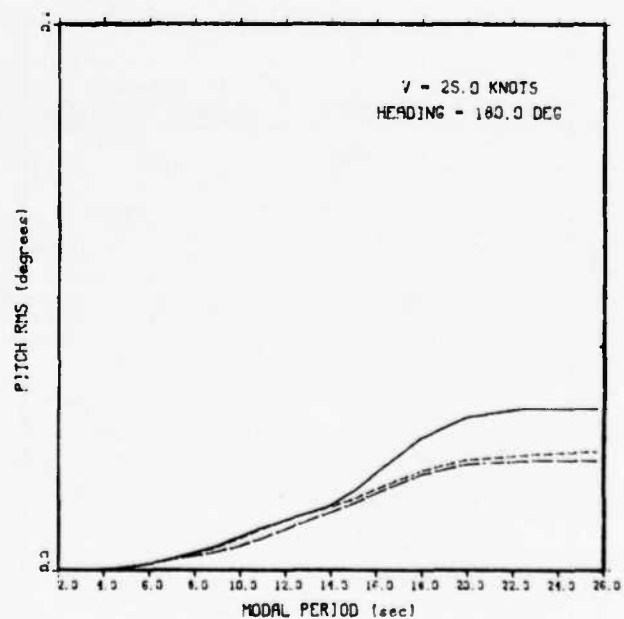
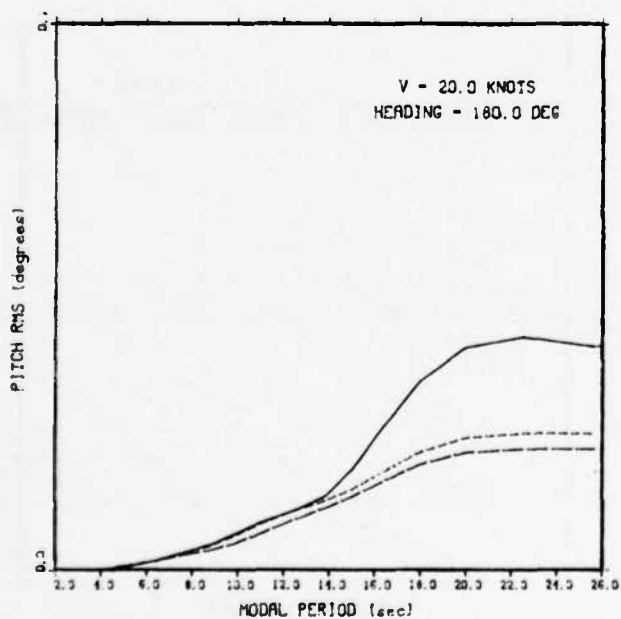
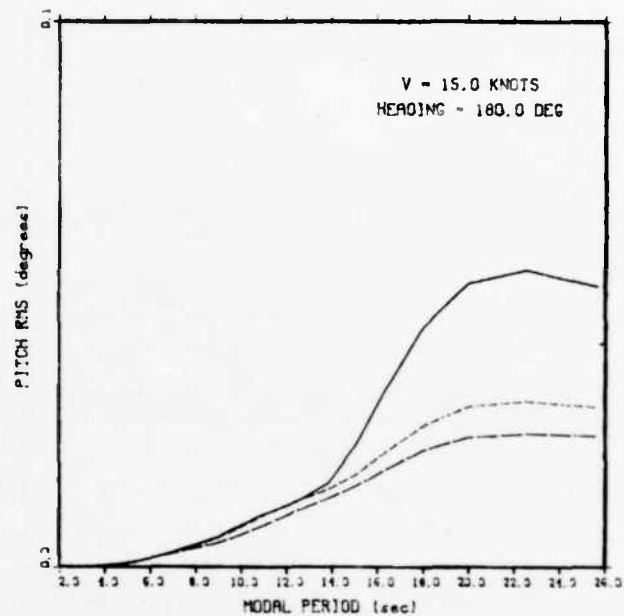
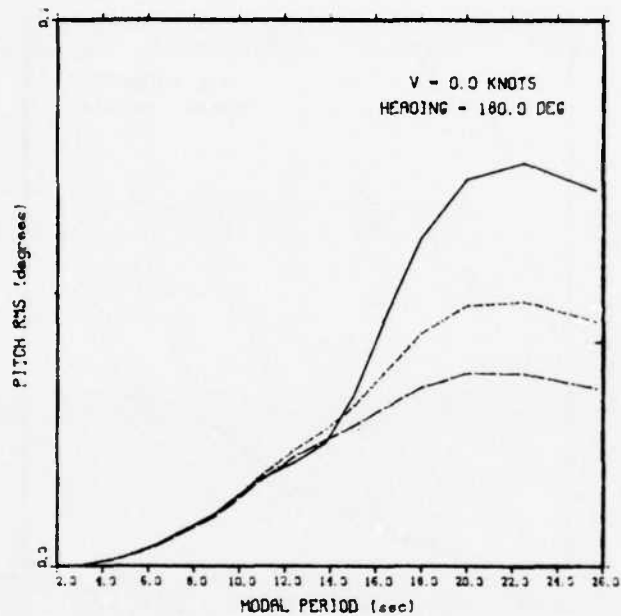


Figure 3h - Responses for Configurations 1321, 1322, and 1323

FIGURE 3 - CONTINUED

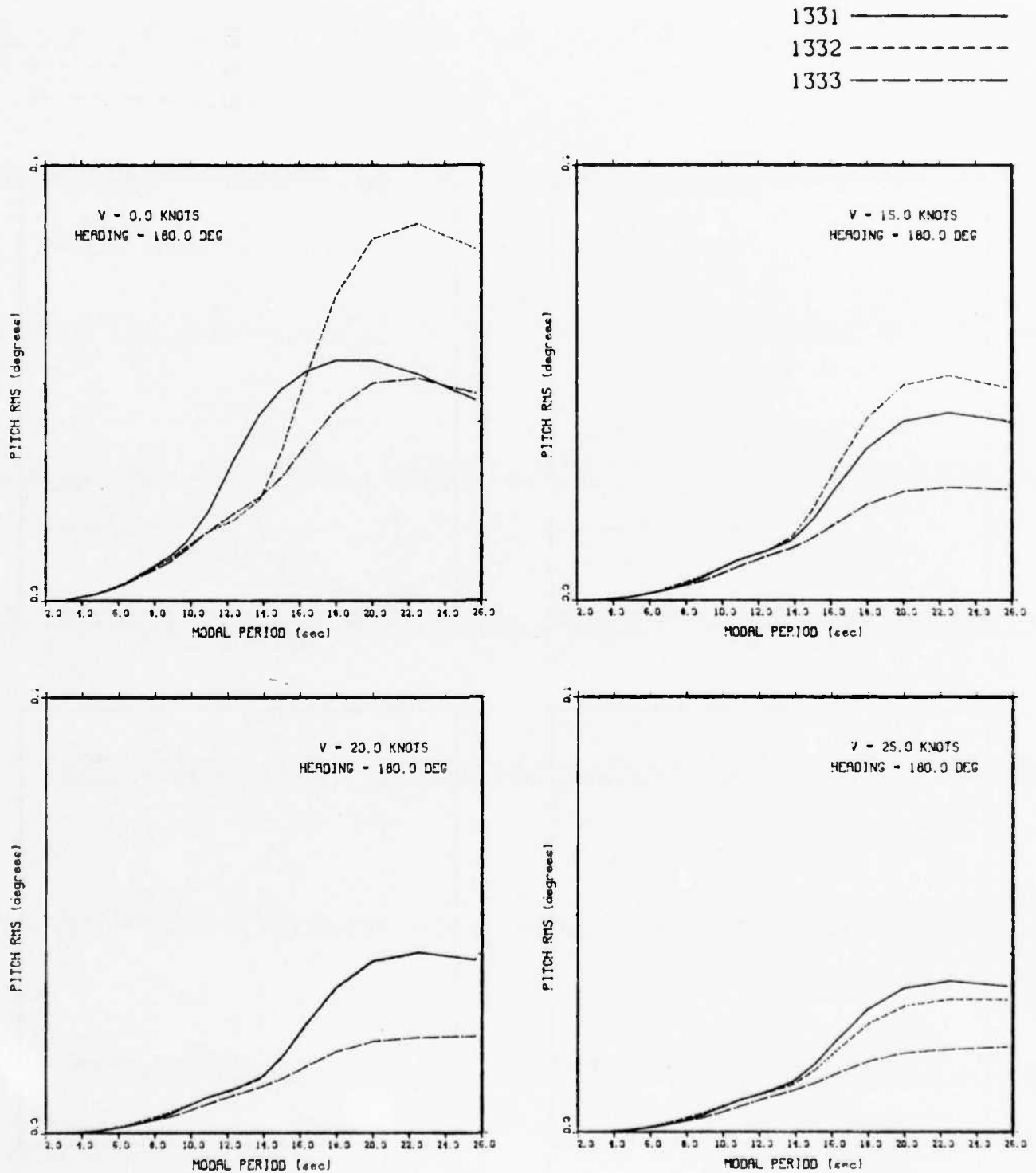


Figure 3i - Responses for Configurations 1331, 1332, and 1333

FIGURE 3 - CONTINUED

2111 —————
 2112 - - - - -
 2113 - - - - -

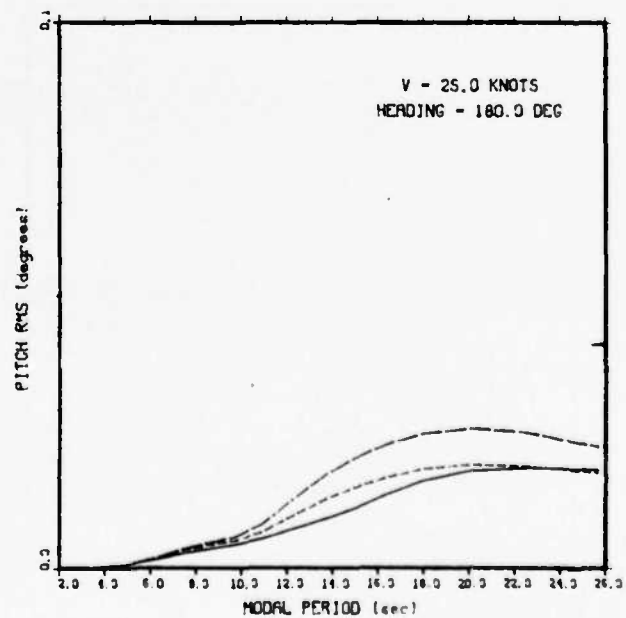
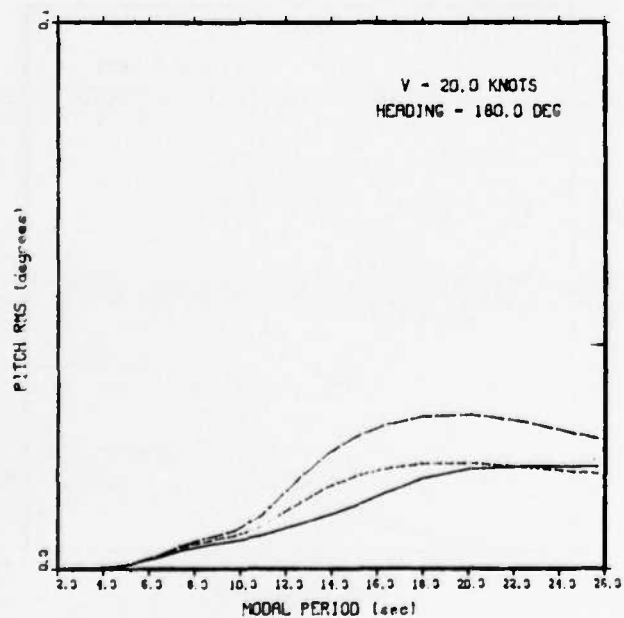
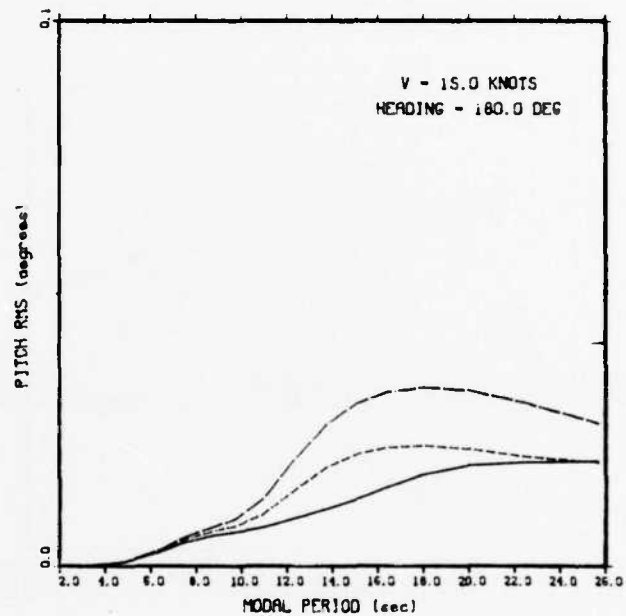
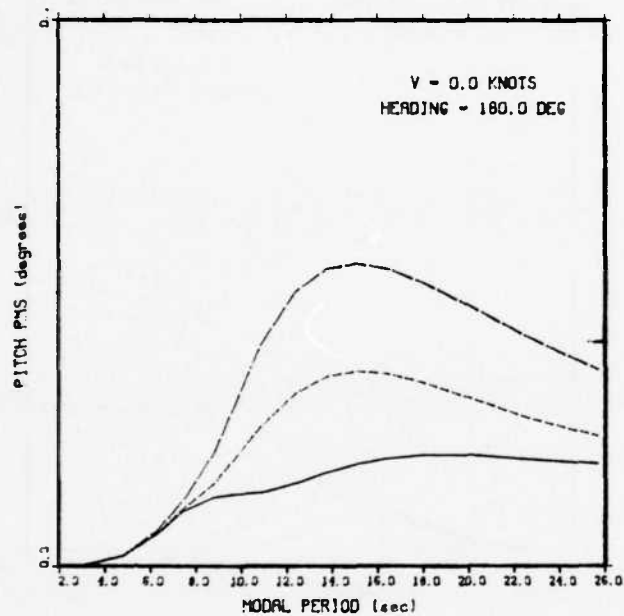


Figure 3j - Responses for Configurations 2111, 2112, and 2113

FIGURE 3 - CONTINUED

2121 —————
 2122 - - - - -
 2123 ————

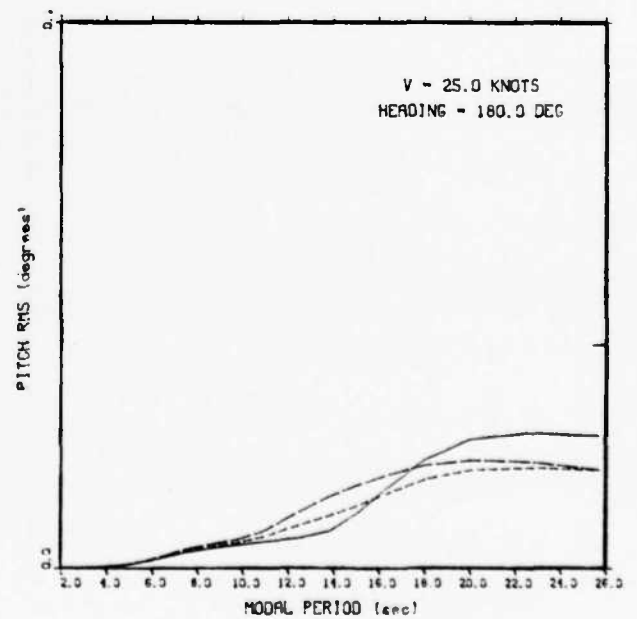
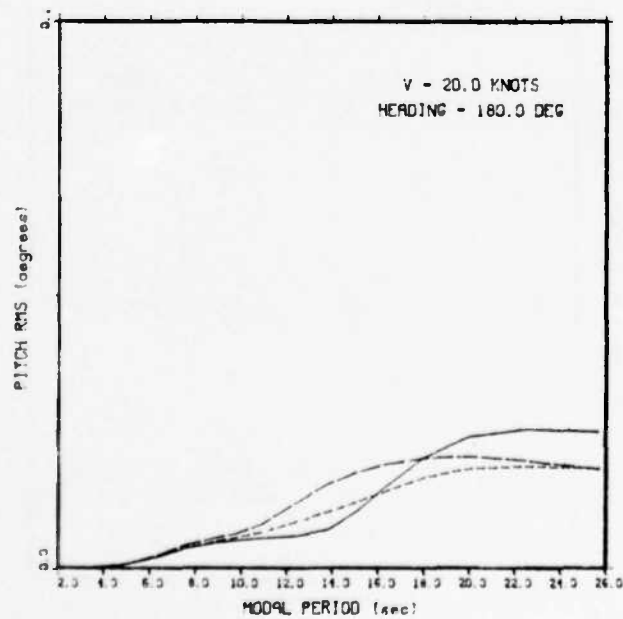
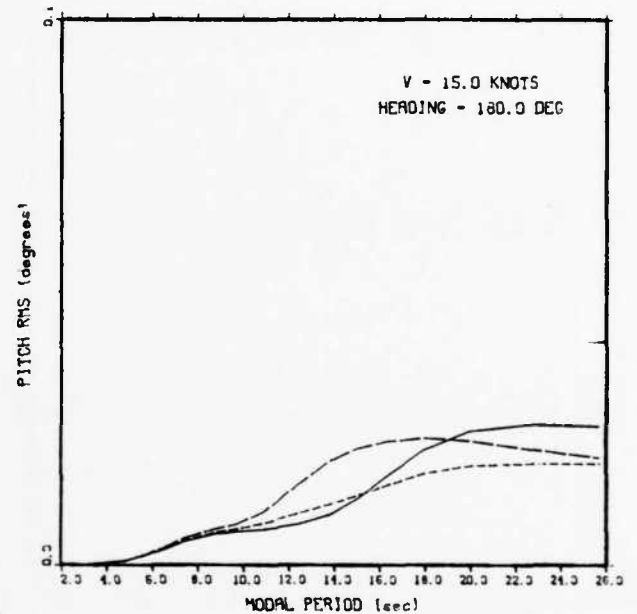
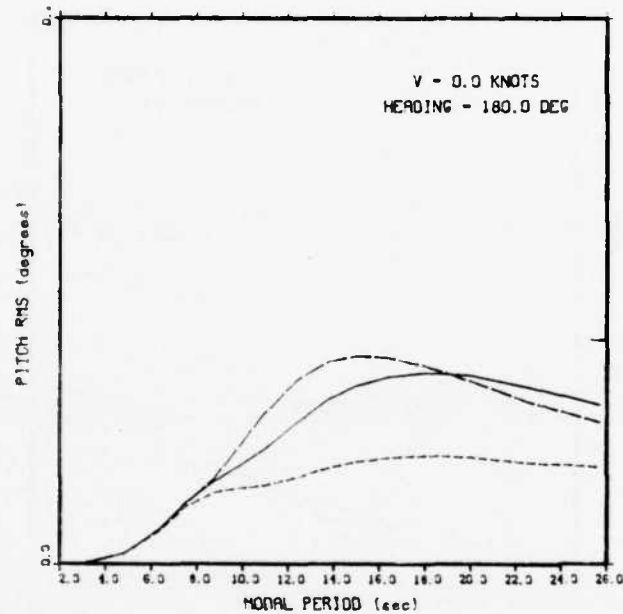


Figure 3k - Responses for Configurations 2121, 2122, and 2123

FIGURE 3 - CONTINUED

2132 - - - - -
2133 - - - - -

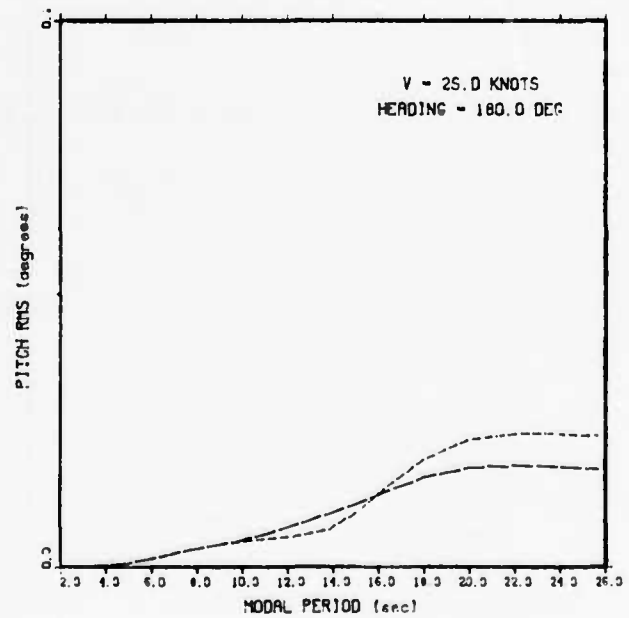
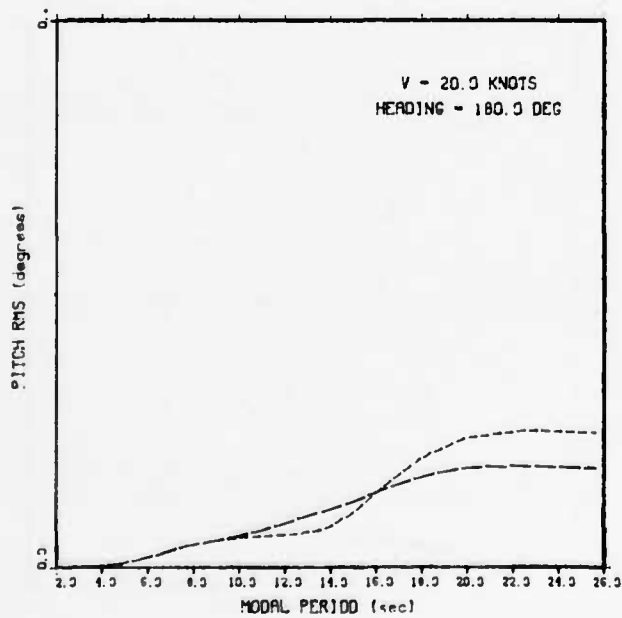
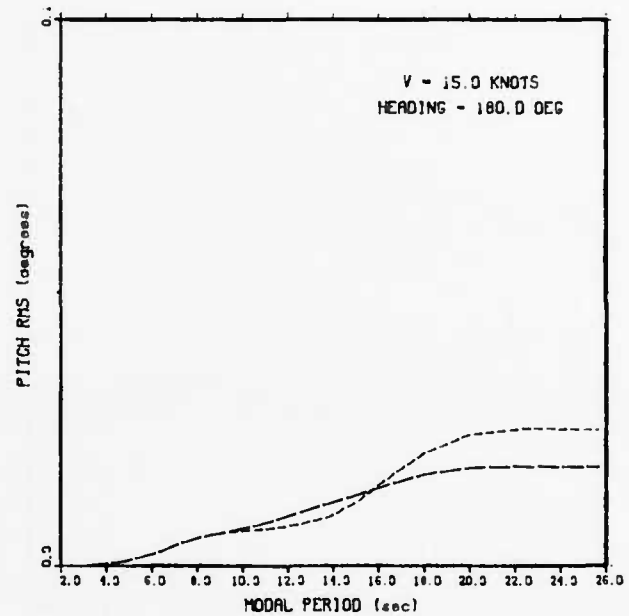
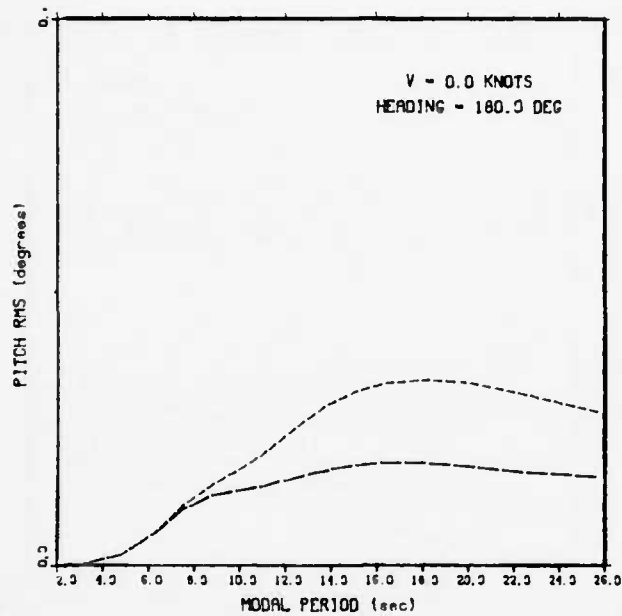


Figure 31 - Responses for Configurations 2132 and 2133

FIGURE 3 - CONTINUED

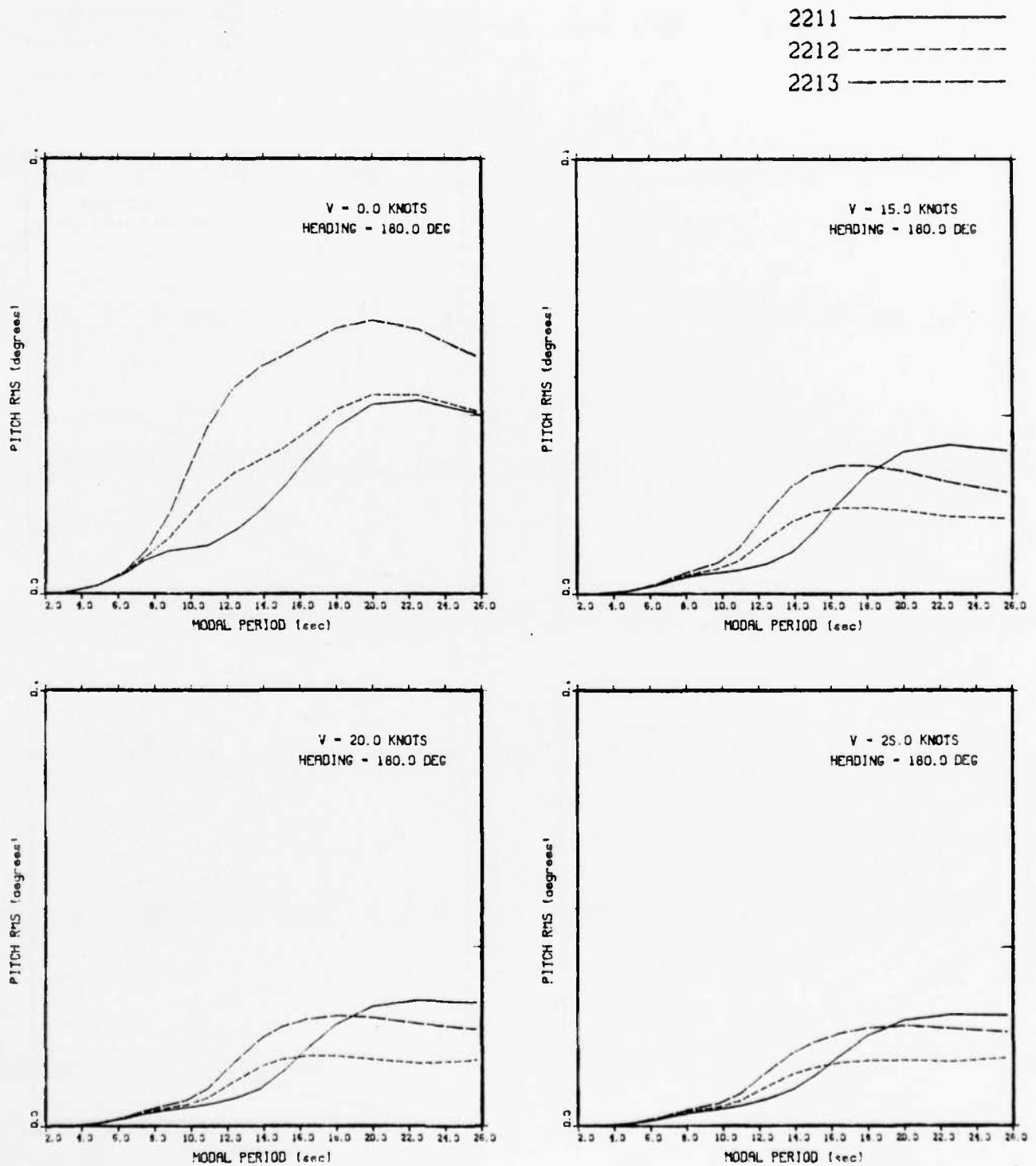


Figure 3m - Responses for Configurations 2211, 2212, and 2213

FIGURE 3 - CONTINUED

2221 —————
 2222 - - - - -
 2223 - - - - -

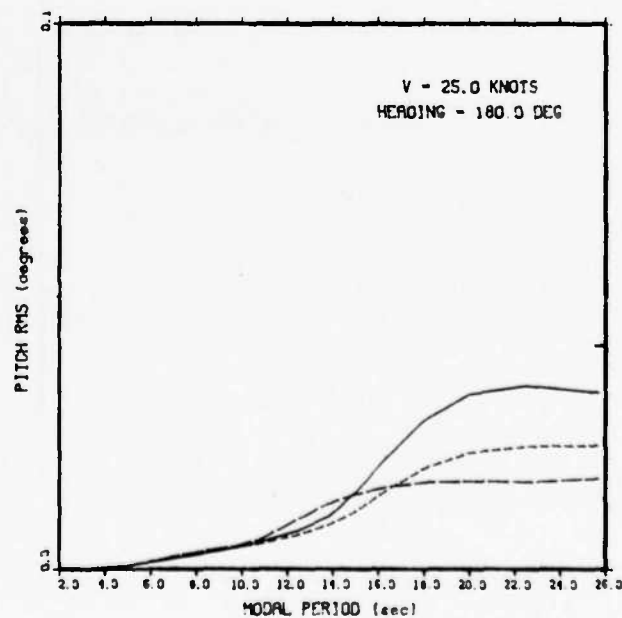
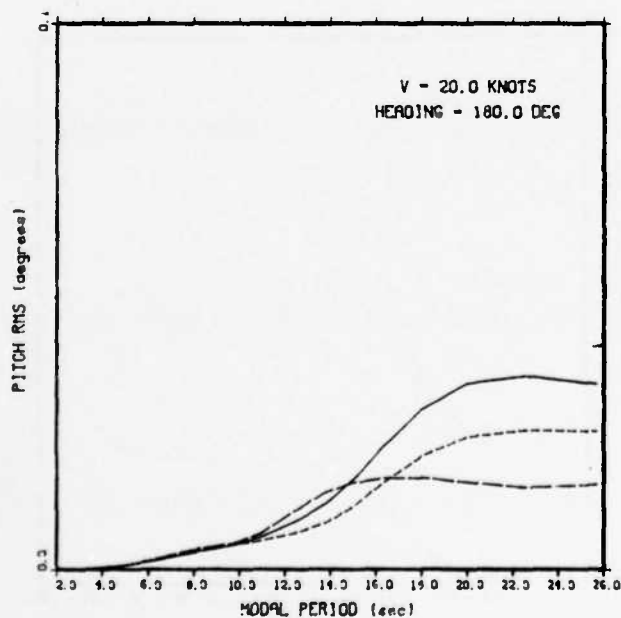
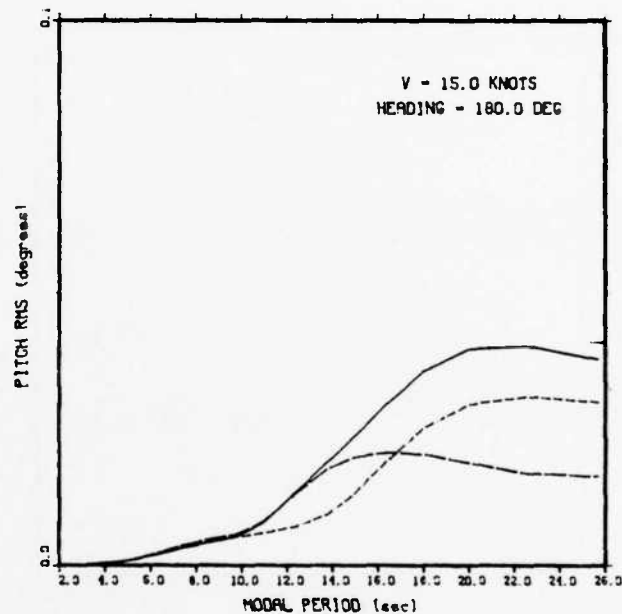
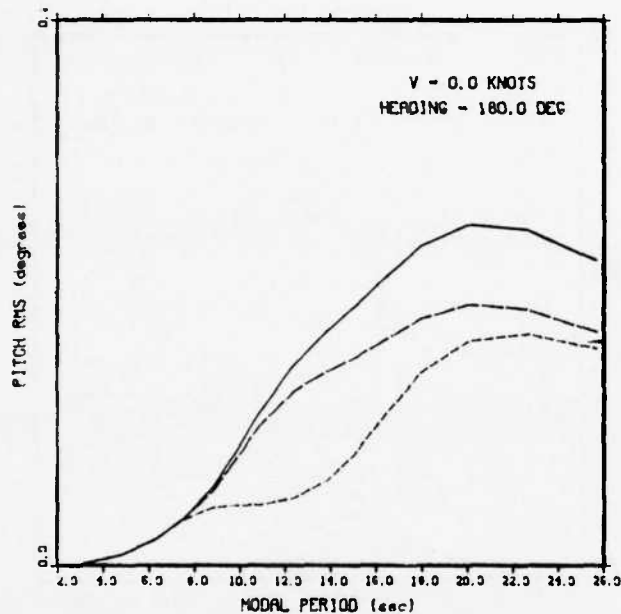


Figure 3n - Responses for Configurations 2221, 2222, and 2223

FIGURE 3 - CONTINUED

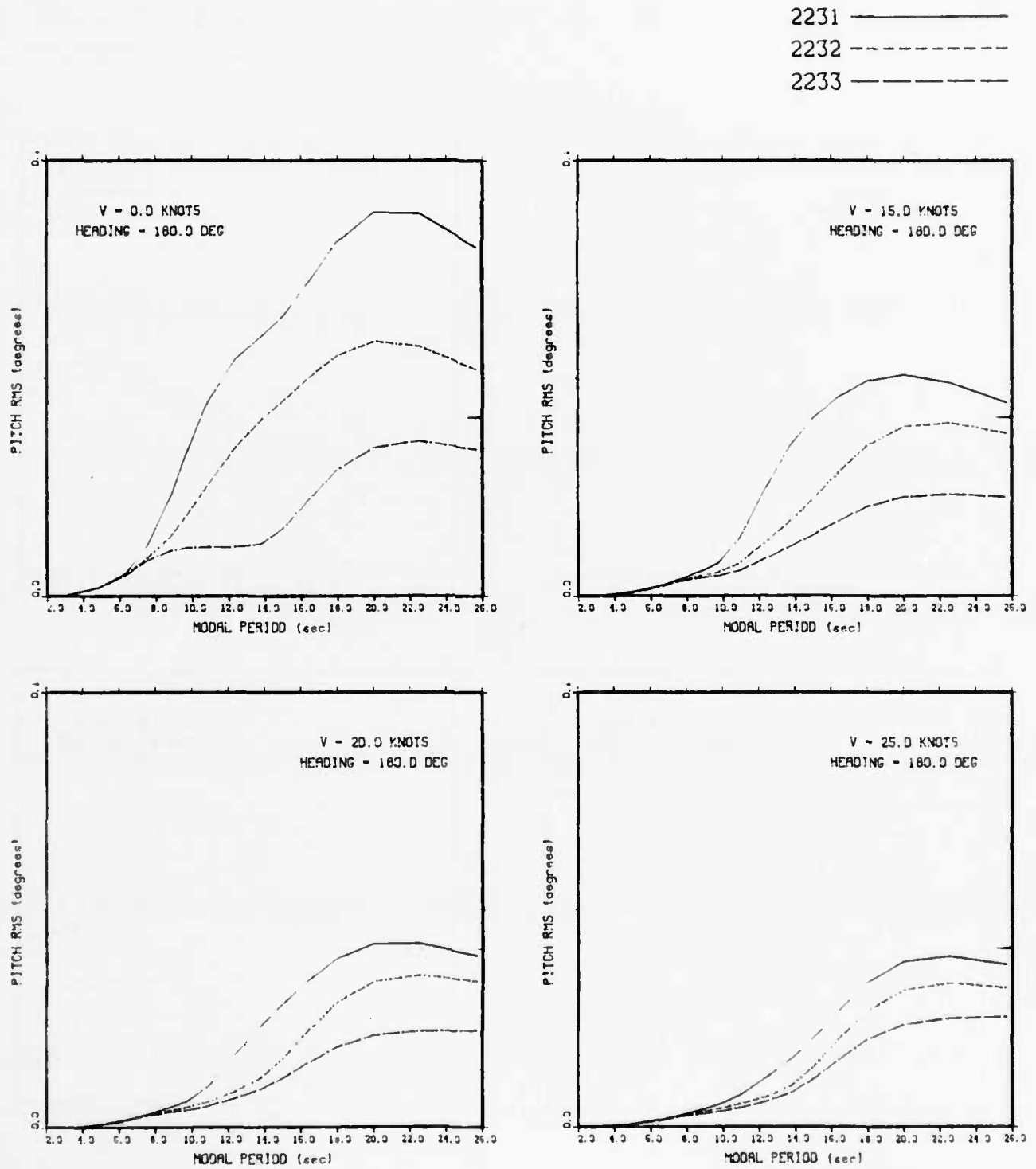


Figure 3a - Responses for Configurations 2231, 2232, and 2233

FIGURE 3 - CONTINUED

2311 —————
 2312 - - - - -
 2313 - - - - -

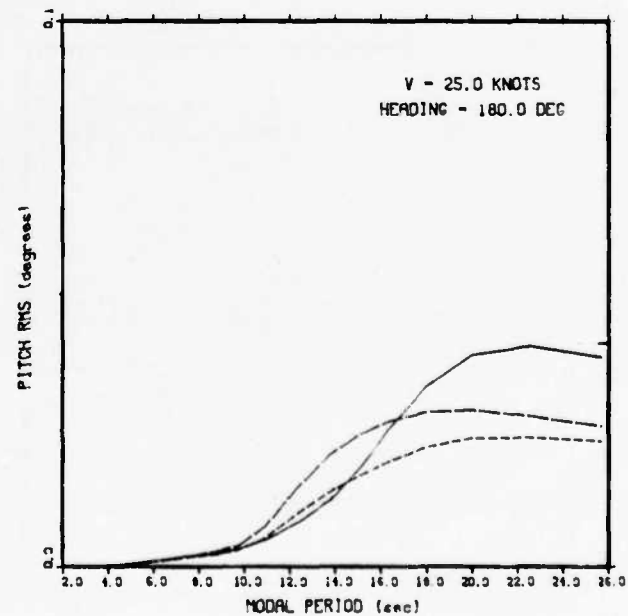
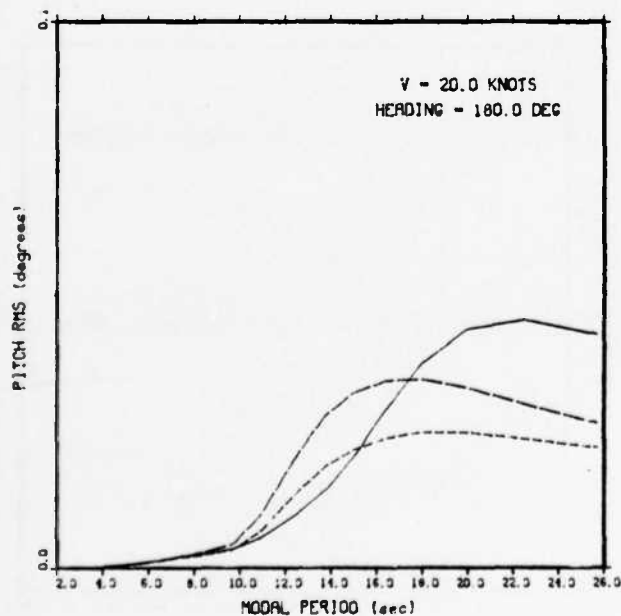
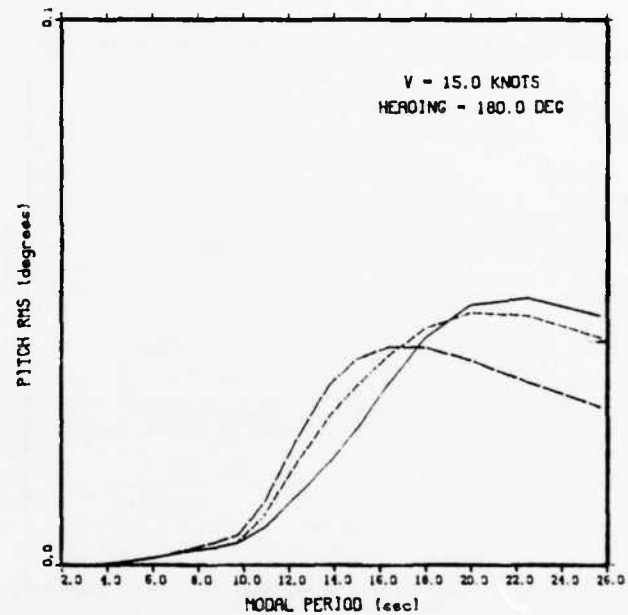
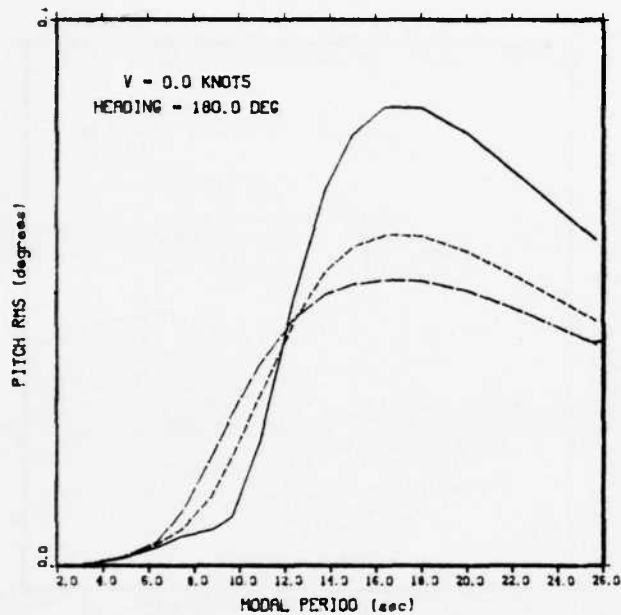


Figure 3p - Responses for Configurations 2311, 2312, and 2313

FIGURE 3 - CONTINUED

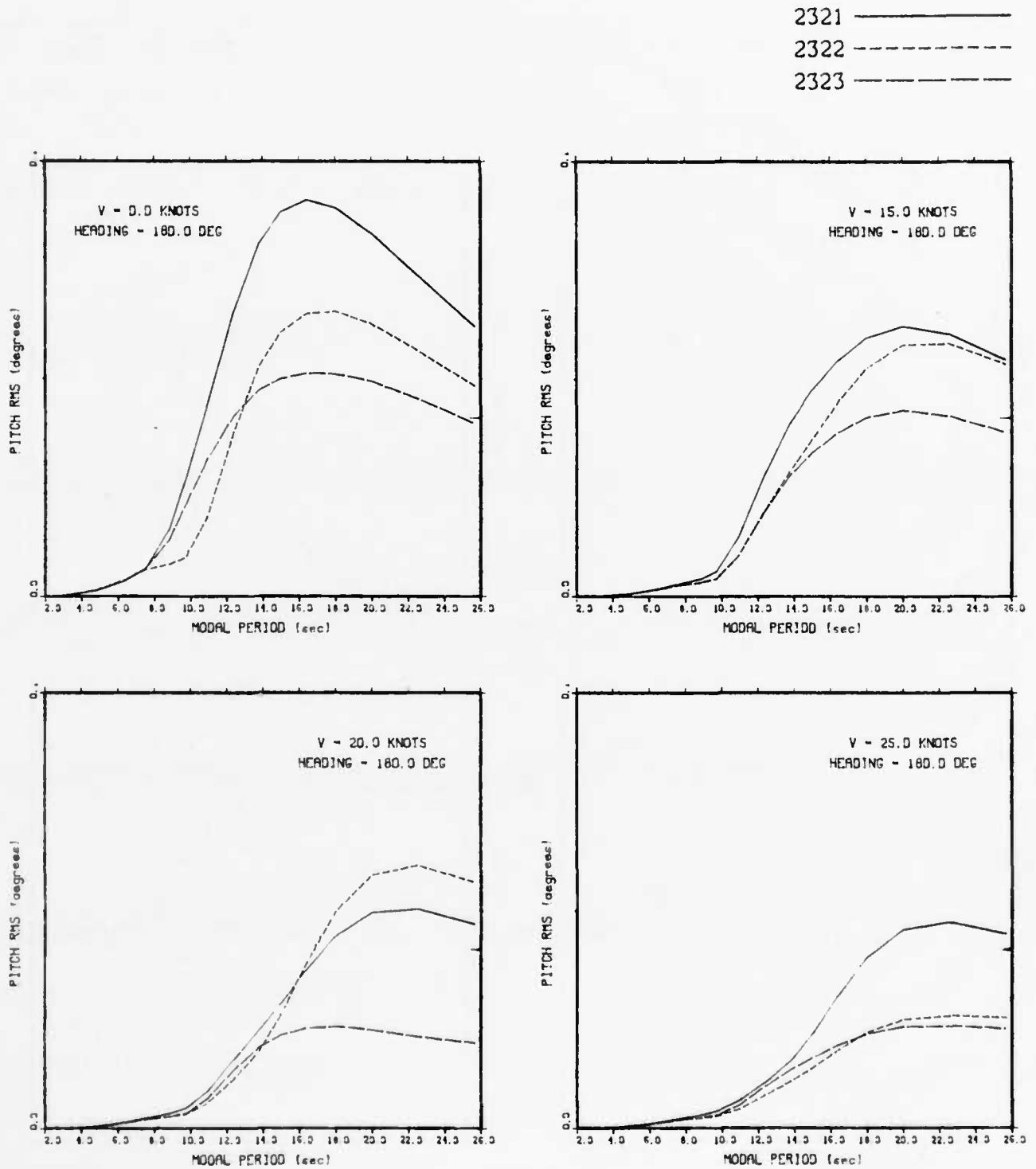


Figure 3q - Responses for Configurations 2321, 2322, and 2323

FIGURE 3 - CONTINUED

2331 —————
 2332 - - - - -
 2333 —————

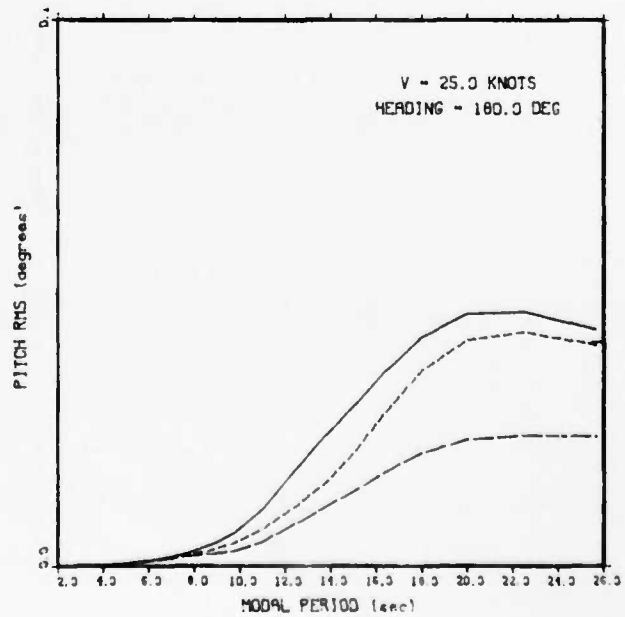
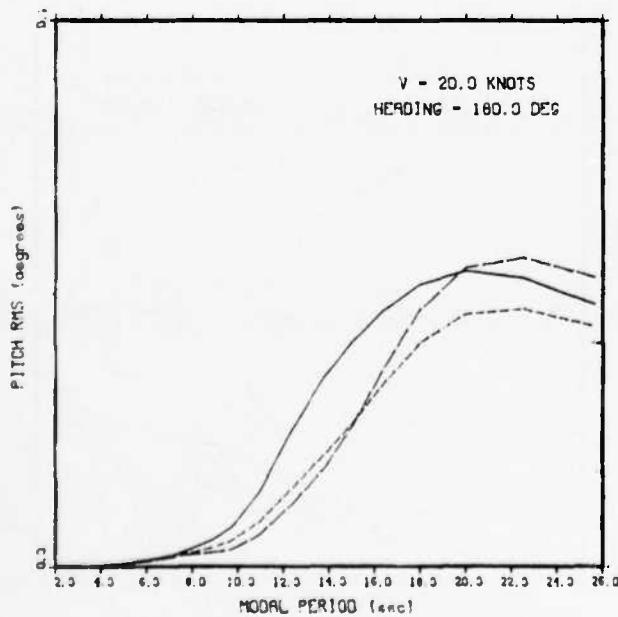
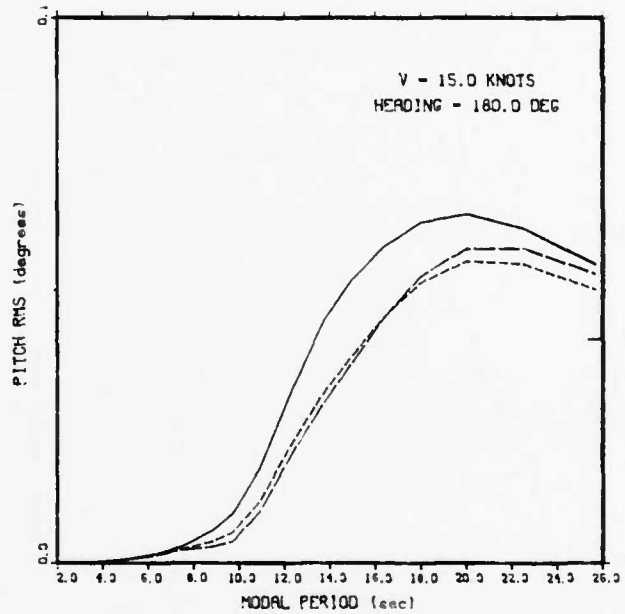
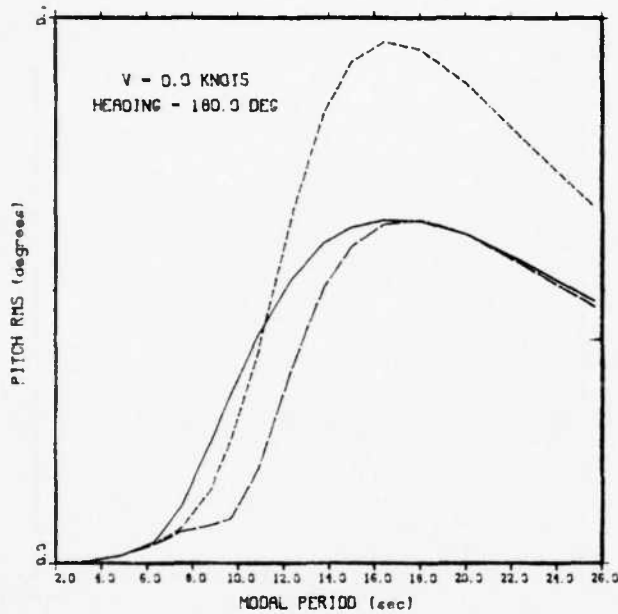


Figure 3r - Responses for Configurations 2331, 2332, and 2333

FIGURE 3 - CONTINUED

3111 —————
 3112 - - - - -
 3113 — · — · —

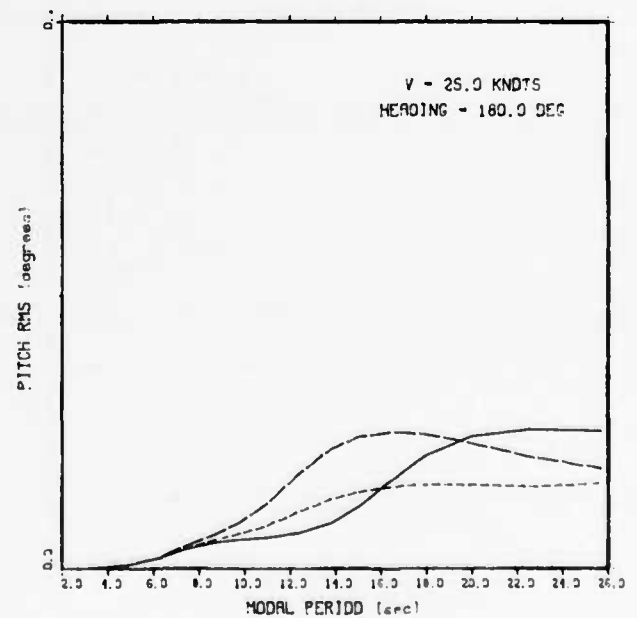
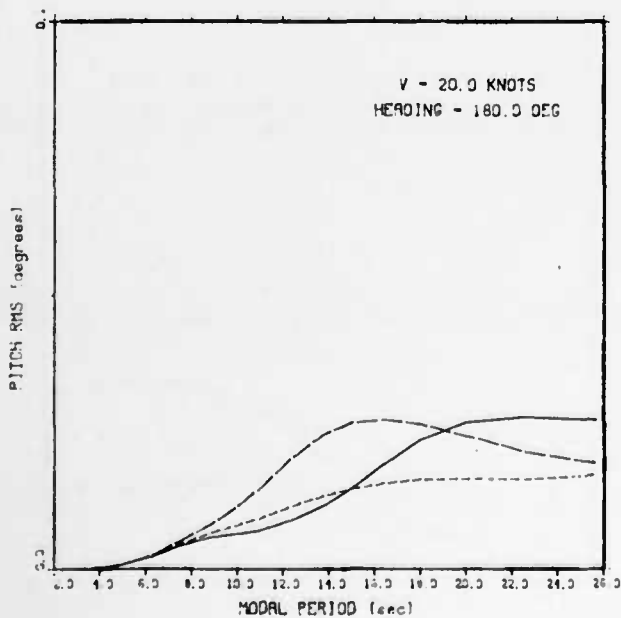
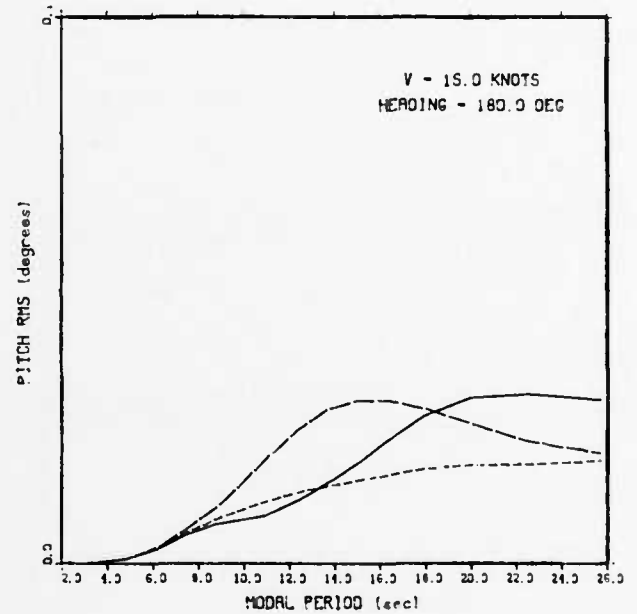
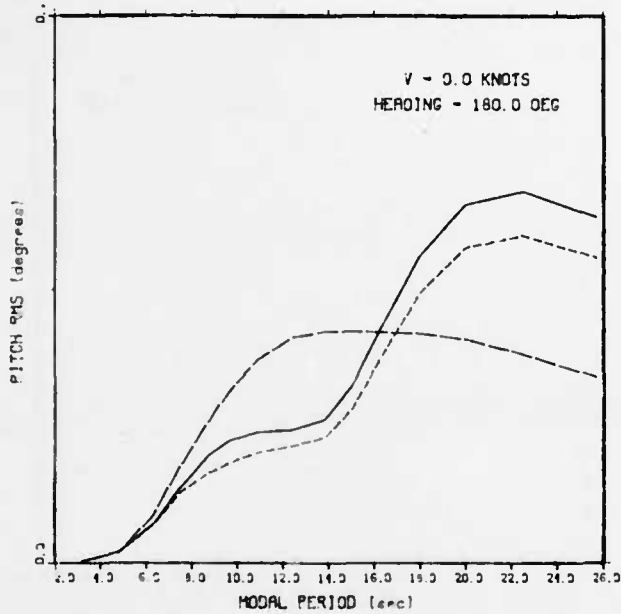


Figure 3s - Responses for Configurations 3111, 3112, and 3113

FIGURE 3 - CONTINUED

3121 —————
 3122 - - - - -
 3123 - - - - -

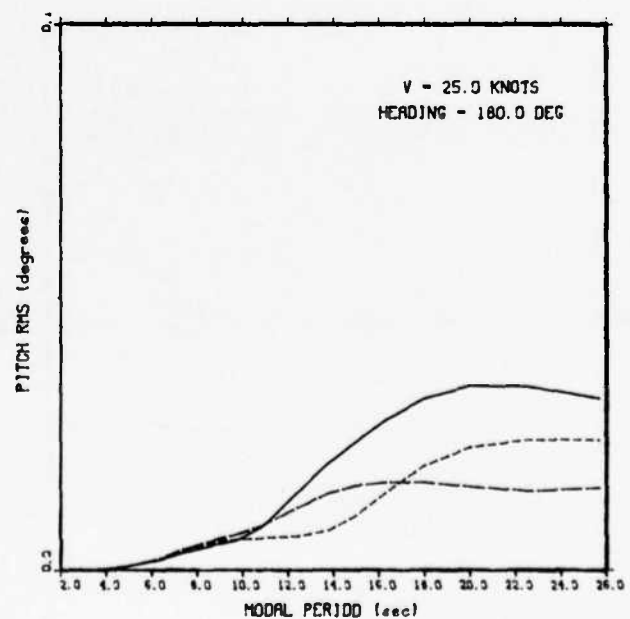
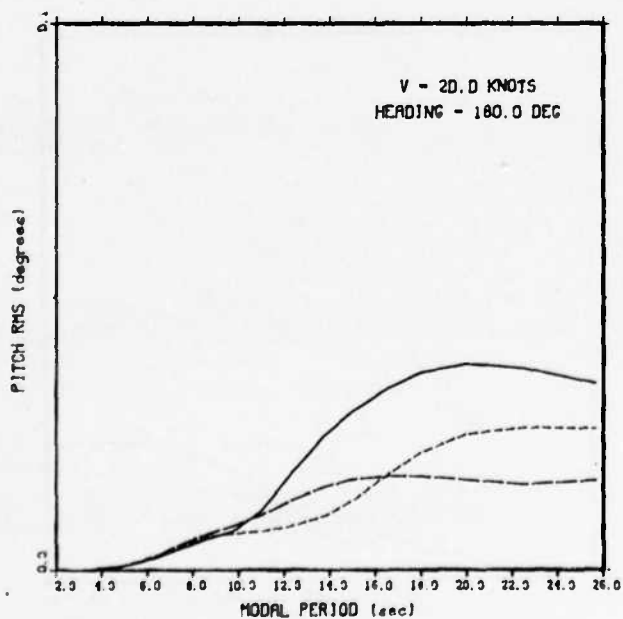
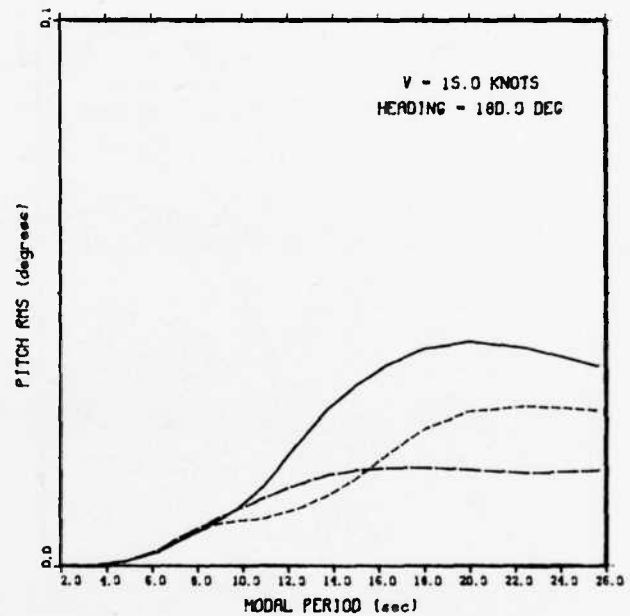
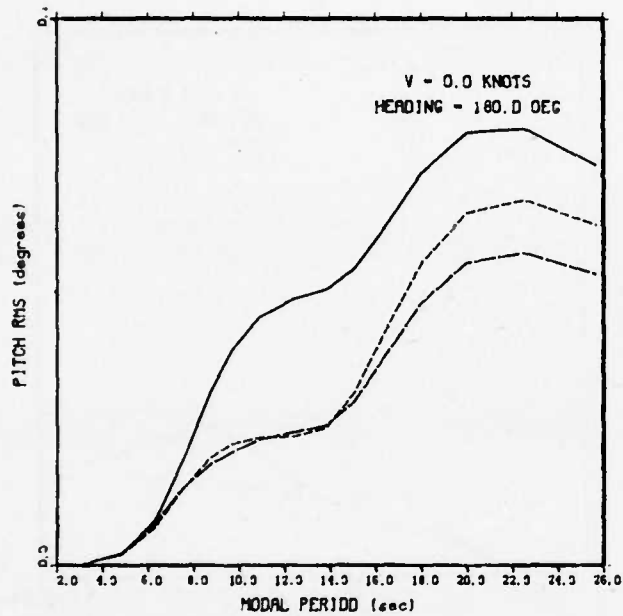


Figure 3t - Responses for Configurations 3121, 3122, and 3123

FIGURE 3 - CONTINUED

3132 - - - - -
3133 - - - - -

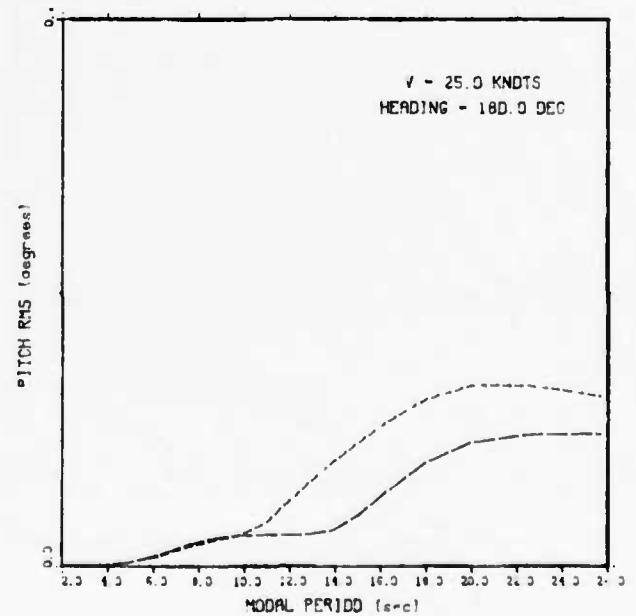
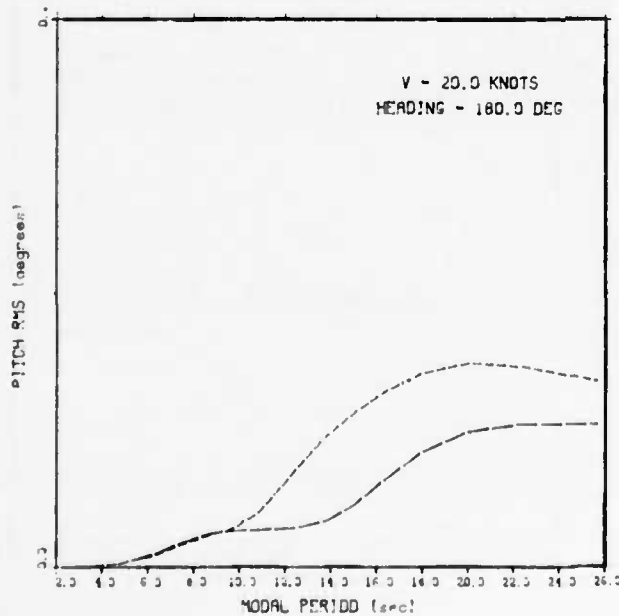
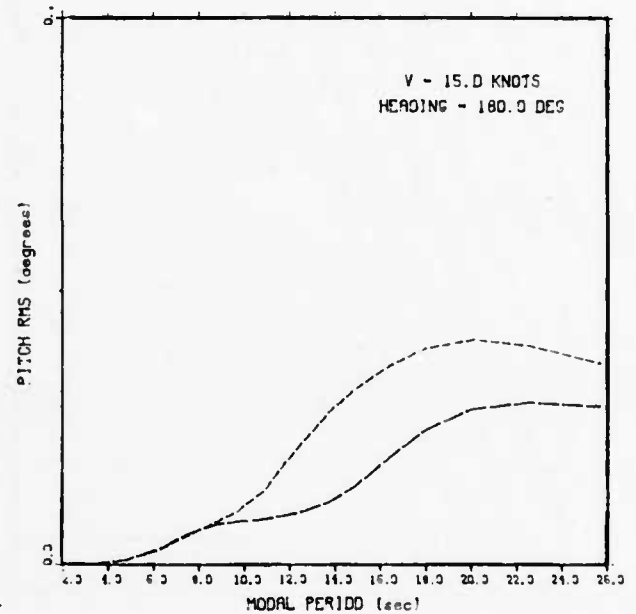
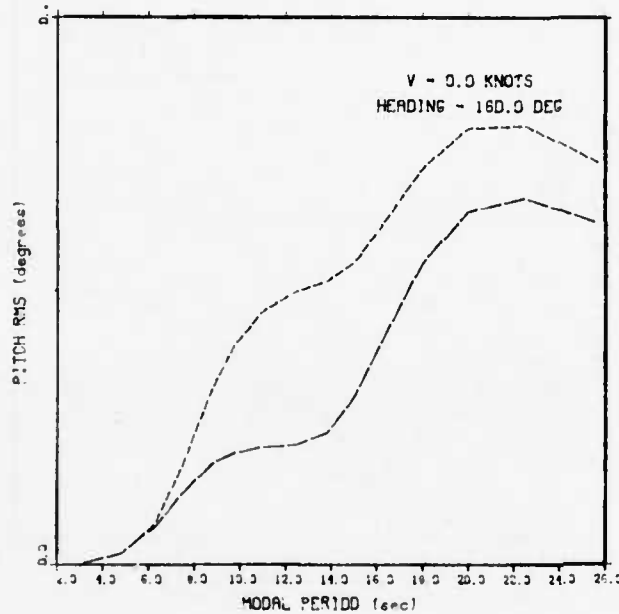


Figure 3u - Responses for Configurations 3132 and 3133

FIGURE 3 - CONTINUED

3211 —————
 3212 - - - - -
 3213 ————

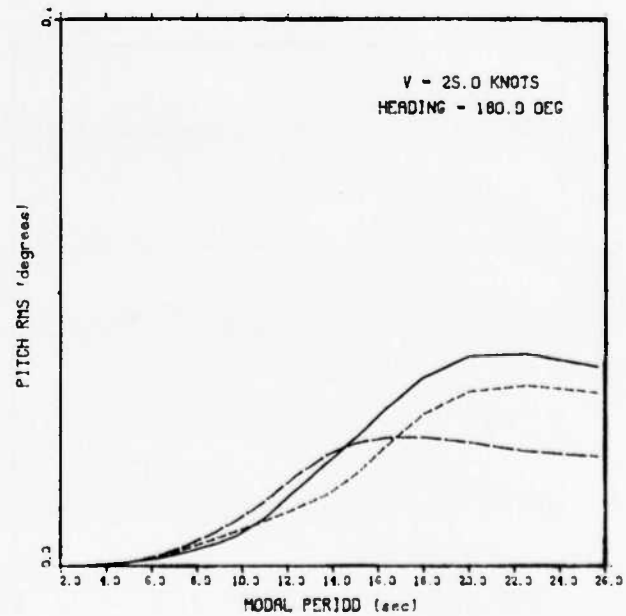
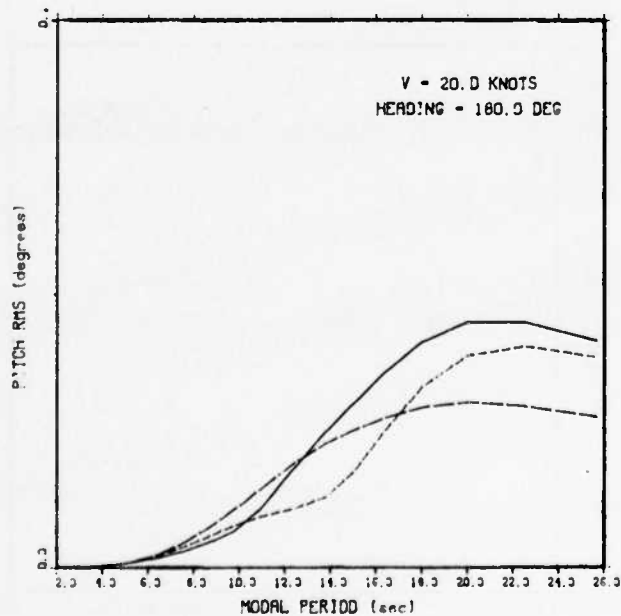
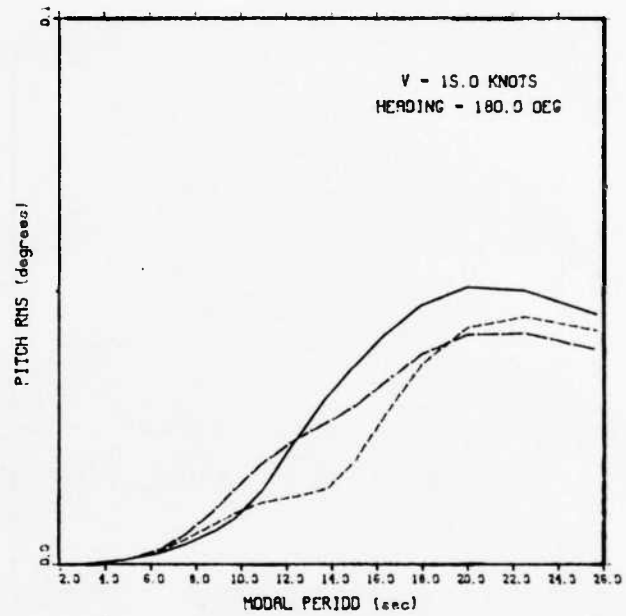
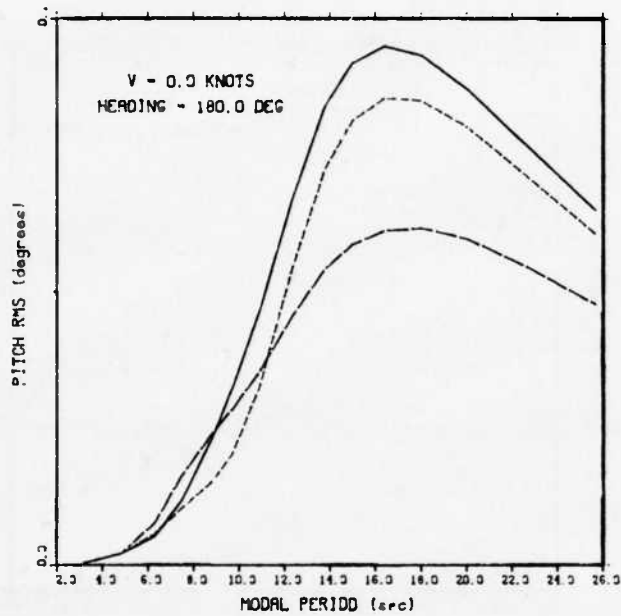


Figure 3v - Responses for Configurations 3211, 3212, and 3213

FIGURE 3 - CONTINUED

3221 —————
 3222 - - - - -
 3223 ————

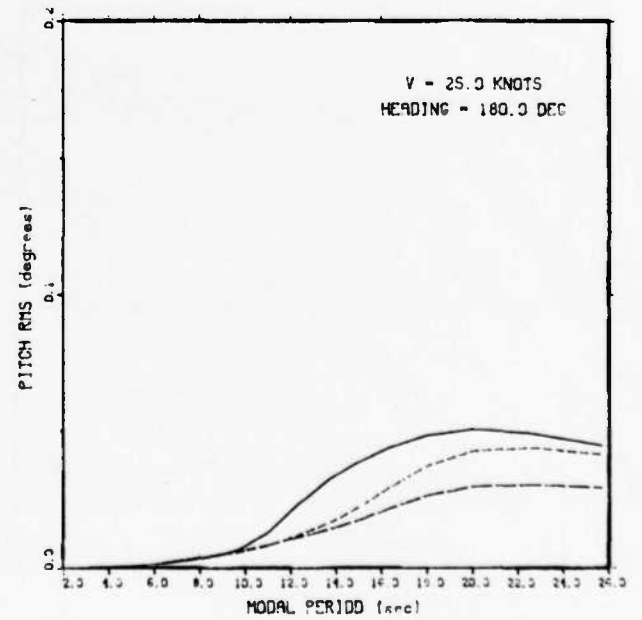
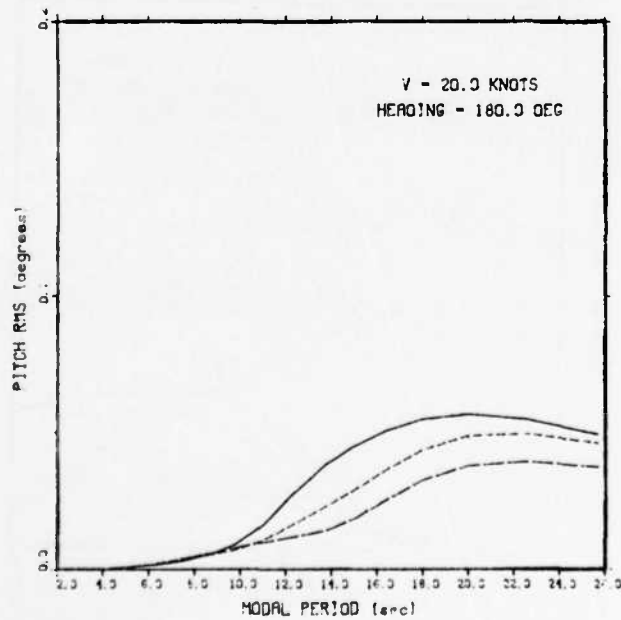
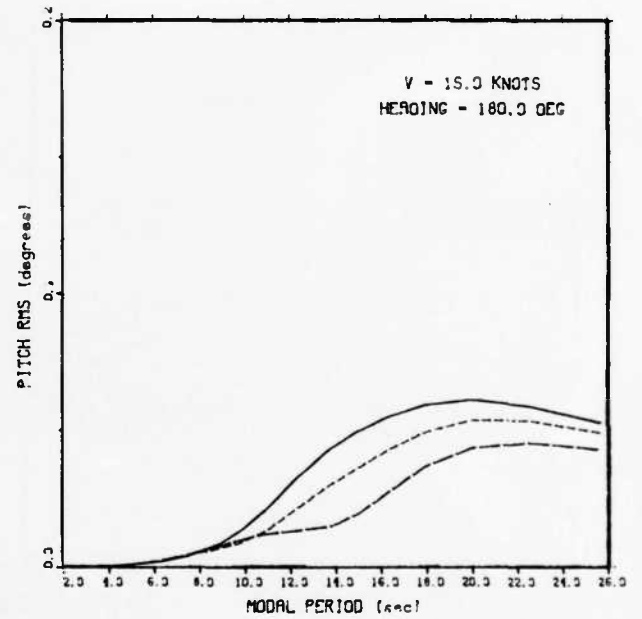
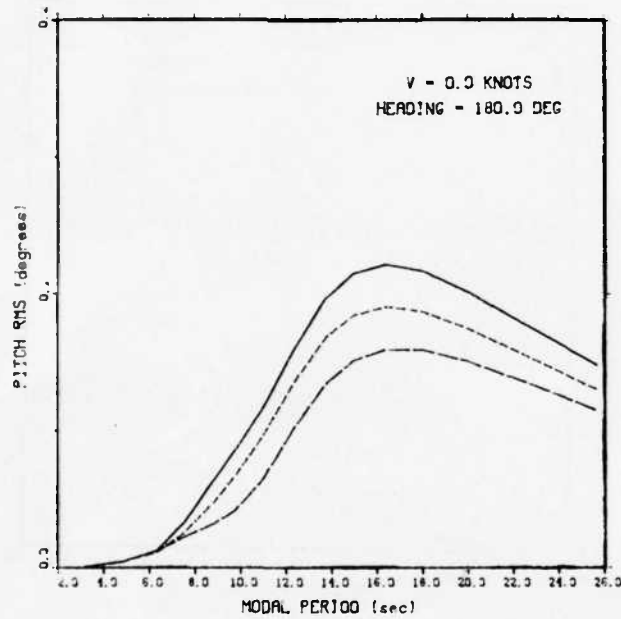


Figure 3w - Responses for Configurations 3221, 3222, and 3223

FIGURE 3 - CONTINUED

3231 —————
 3232 - - - - -
 3233 ————

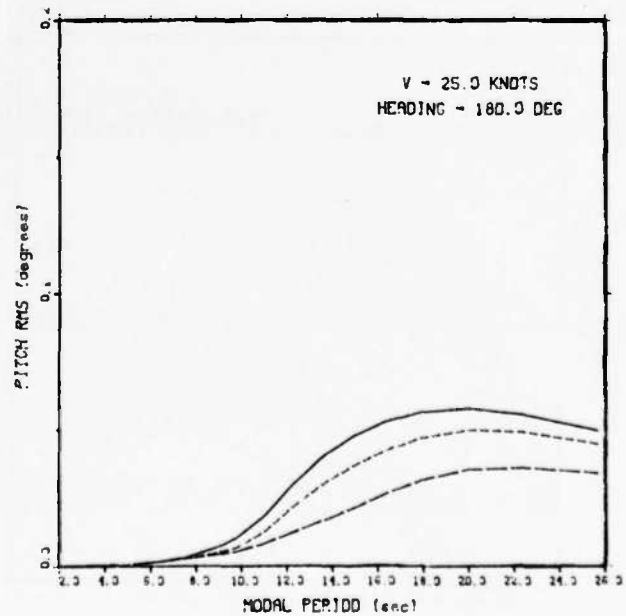
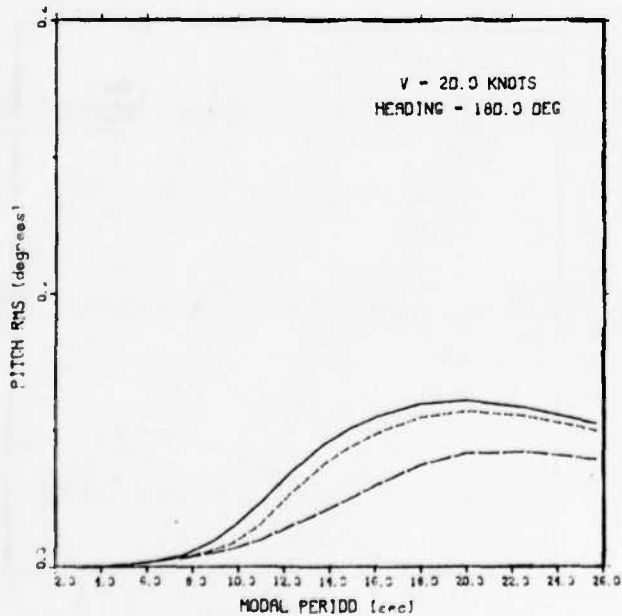
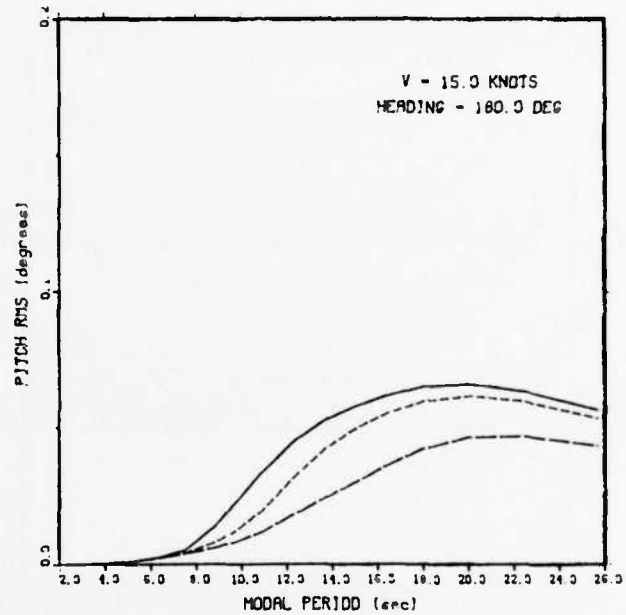
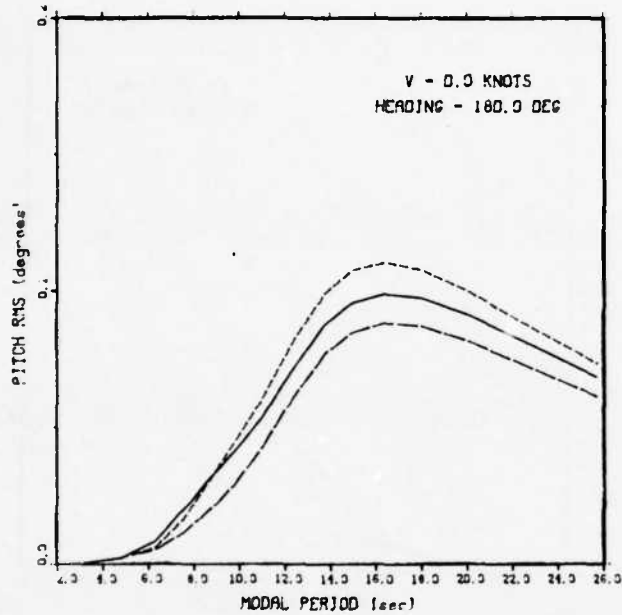


Figure 3x - Responses for Configurations 3231, 3232, and 3233

FIGURE 3 - CONTINUED

3311 —————
 3312 - - - - -
 3313 - - - - -

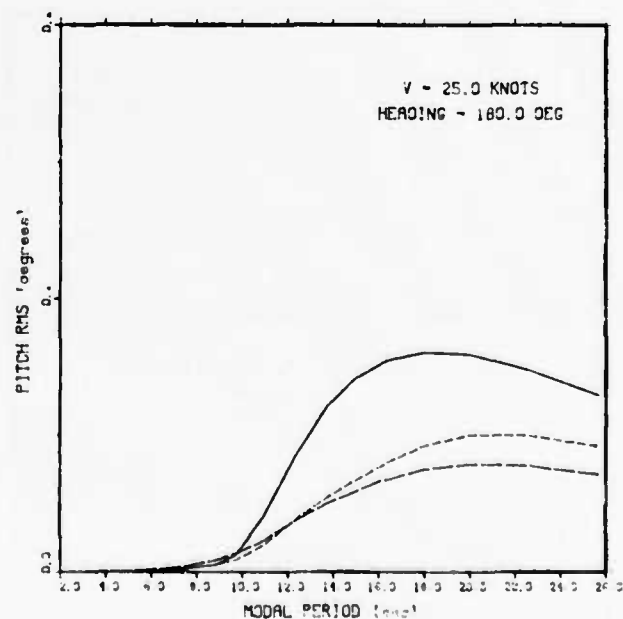
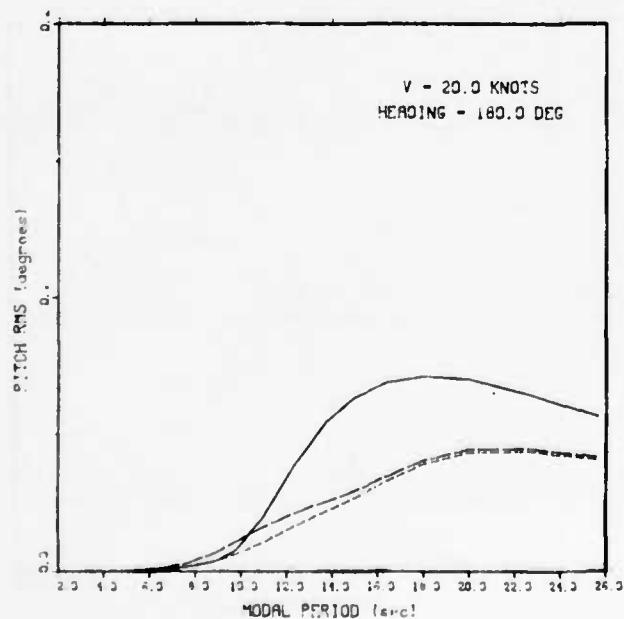
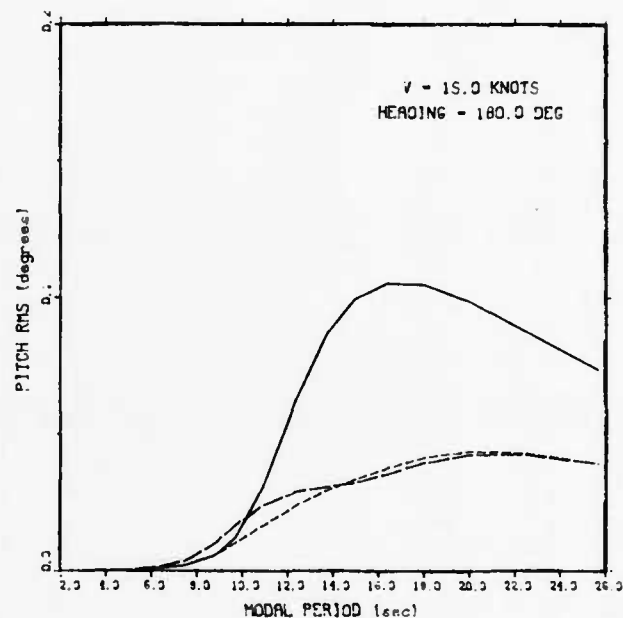
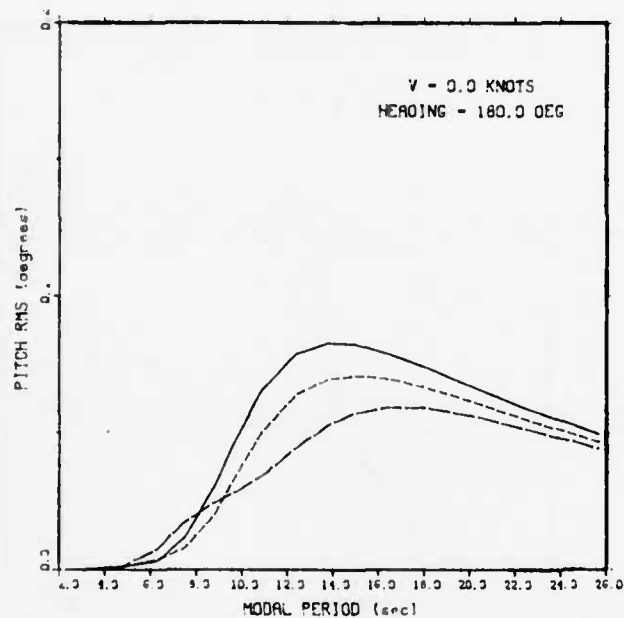


Figure 3y - Responses for Configurations 3311, 3312, and 3313

FIGURE 3 - CONTINUED

3321 —————
 3322 - - - - -
 3323 - - - - -

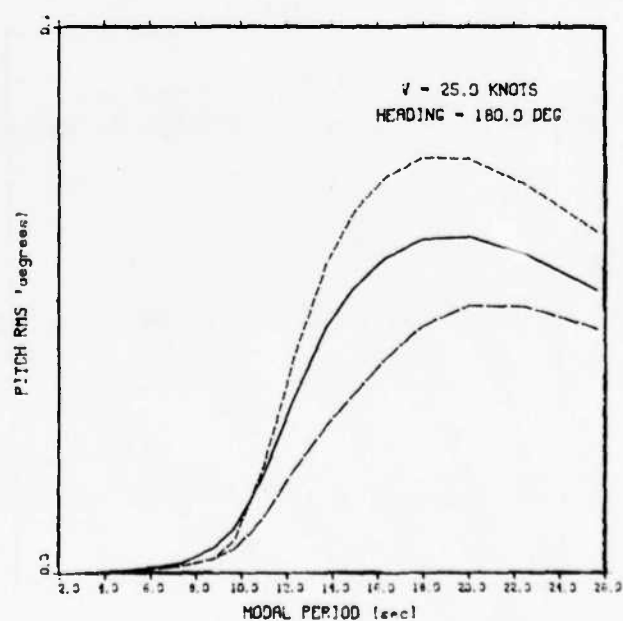
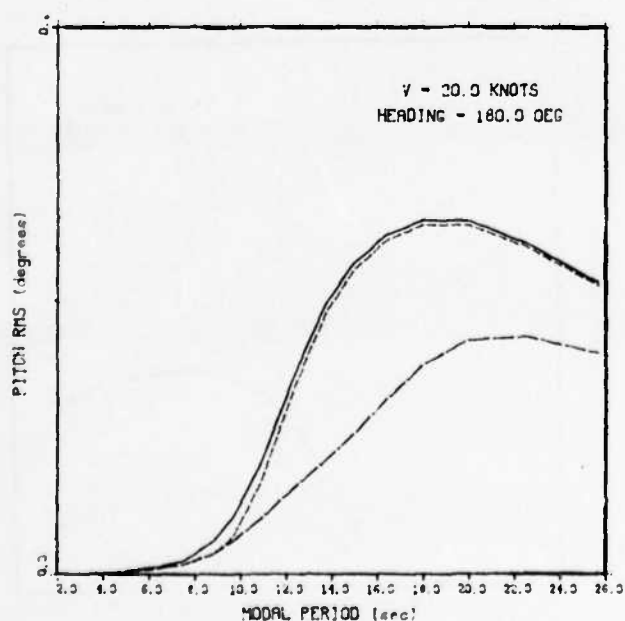
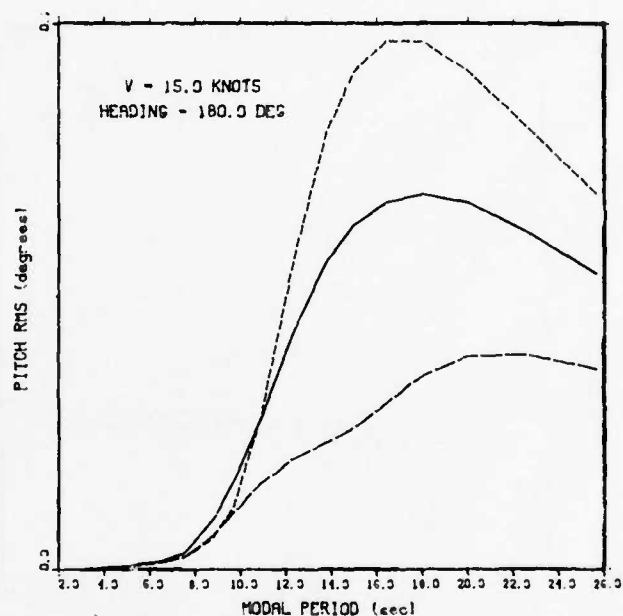
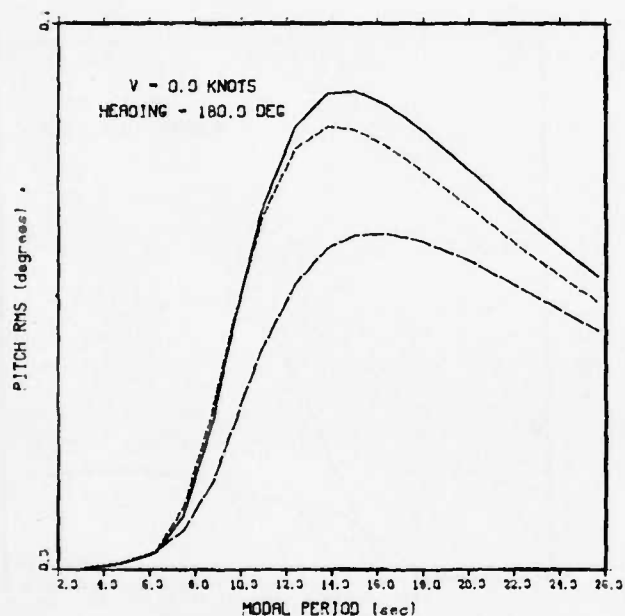


Figure 3z - Responses for Configurations 3321, 3322, and 3323

FIGURE 3 - CONTINUED

3331 —————
 3332 - - - - -
 3333 ————

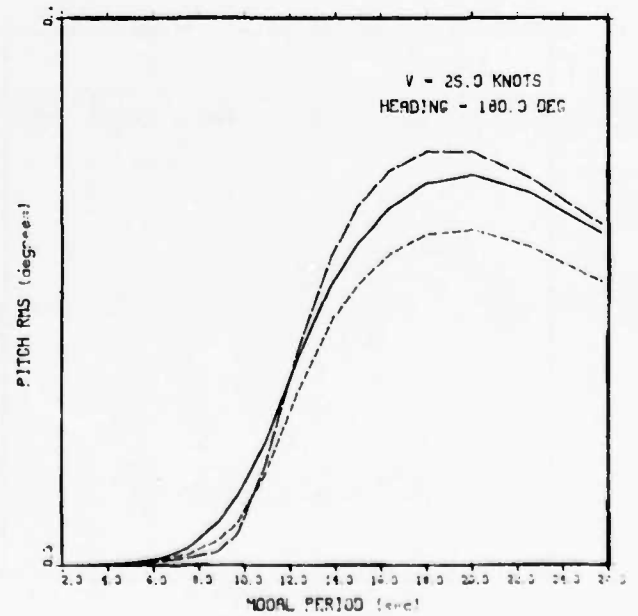
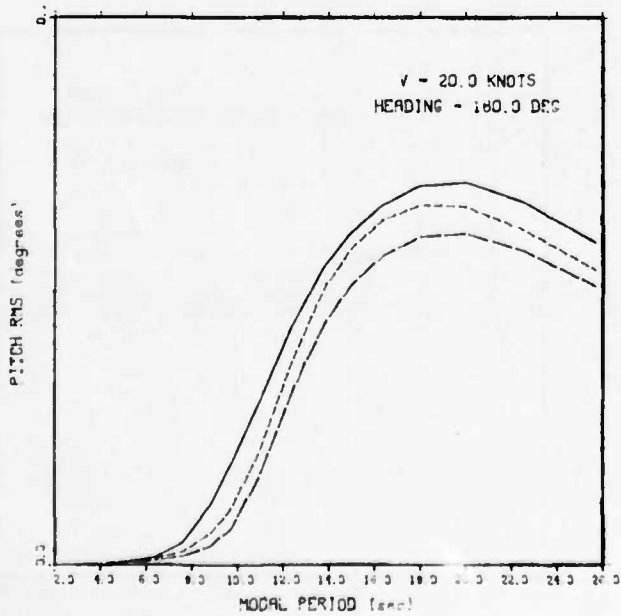
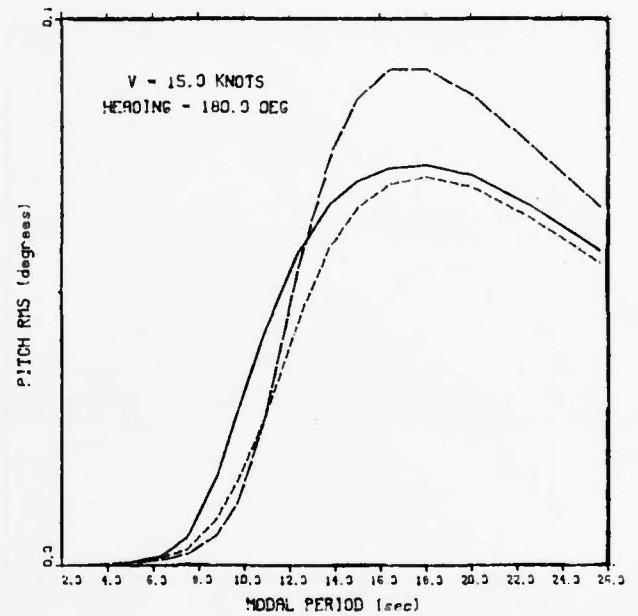
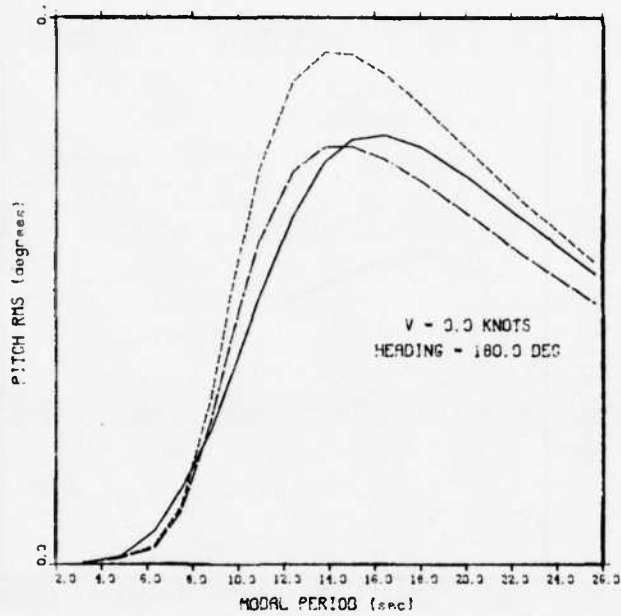


Figure 3aa - Responses for Configurations 3331, 3332, and 3333

FIGURE 4 - RELATIVE BOW MOTION RMS RESPONSES IN HEAD SEAS

1111 —————
1112 - - - - -
1113 - - - - -

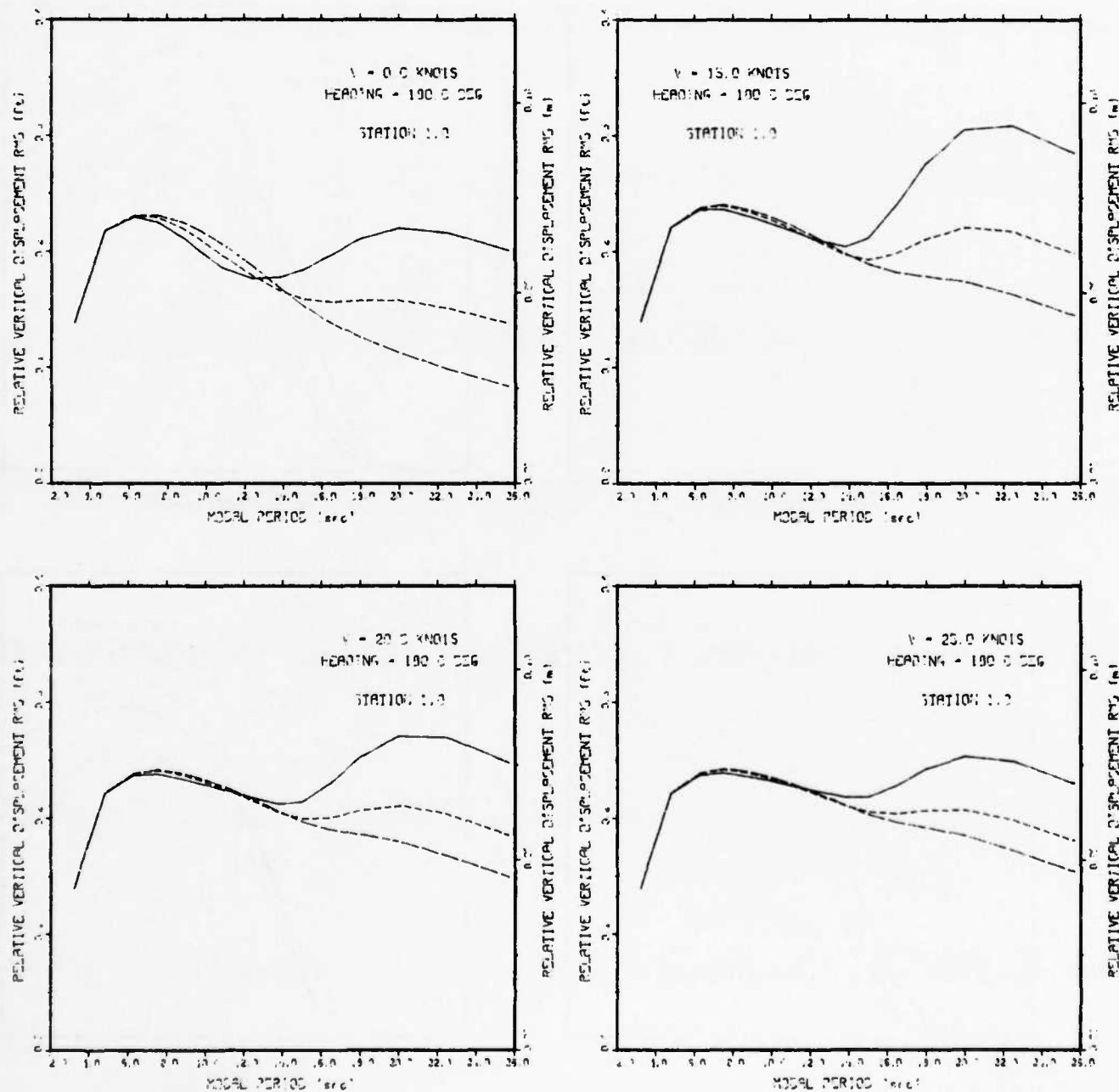


Figure 4a - Responses for Configurations 1111, 1112, and 1113

FIGURE 4 - CONTINUED

1121 —————
 1122 - - - - -
 1123 - · - - -

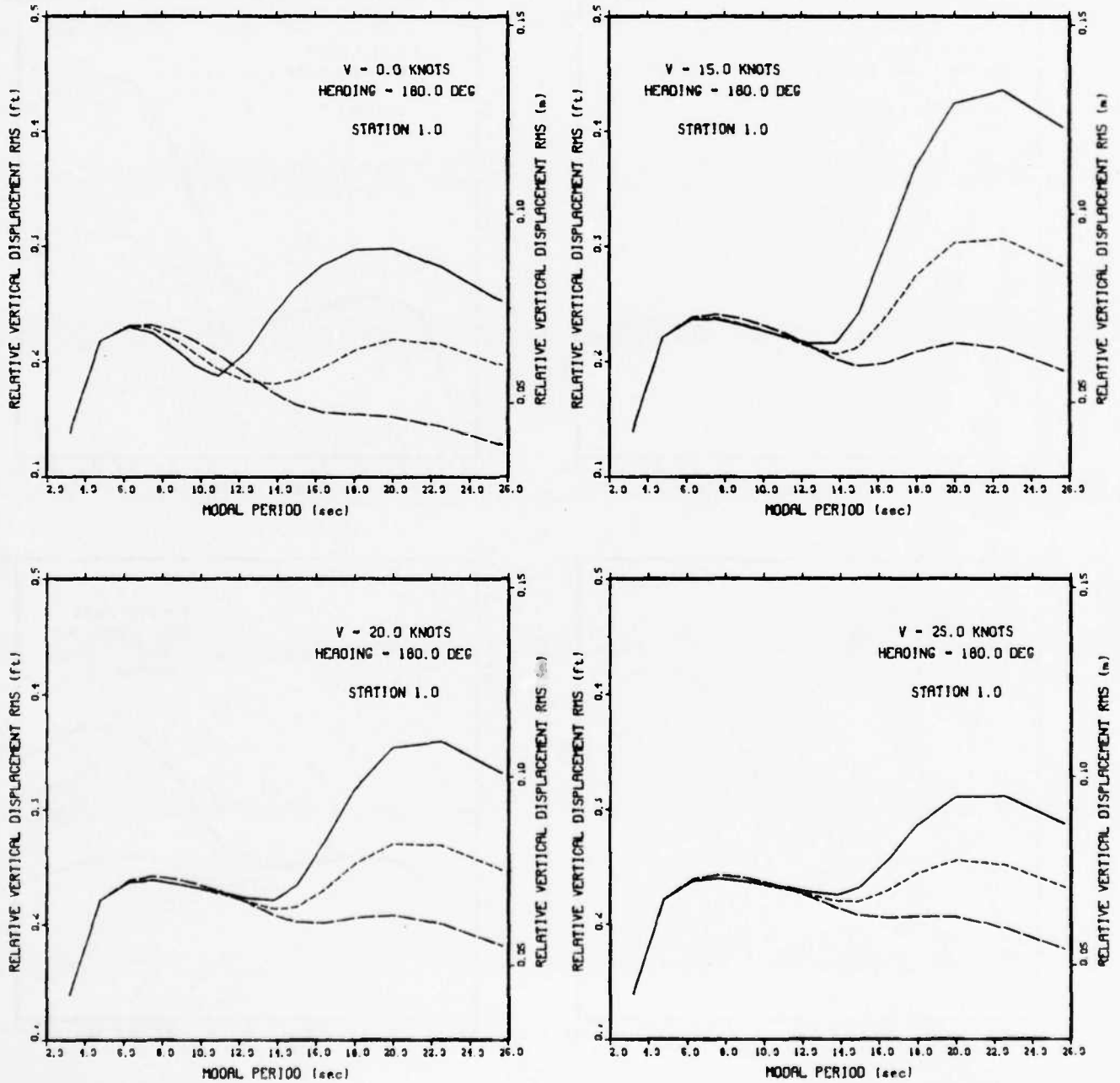


Figure 4b - Responses for Configurations 1121, 1122, and 1123

FIGURE 4 - CONTINUED

1131 —————
 1132 - - - - -
 1133 ————

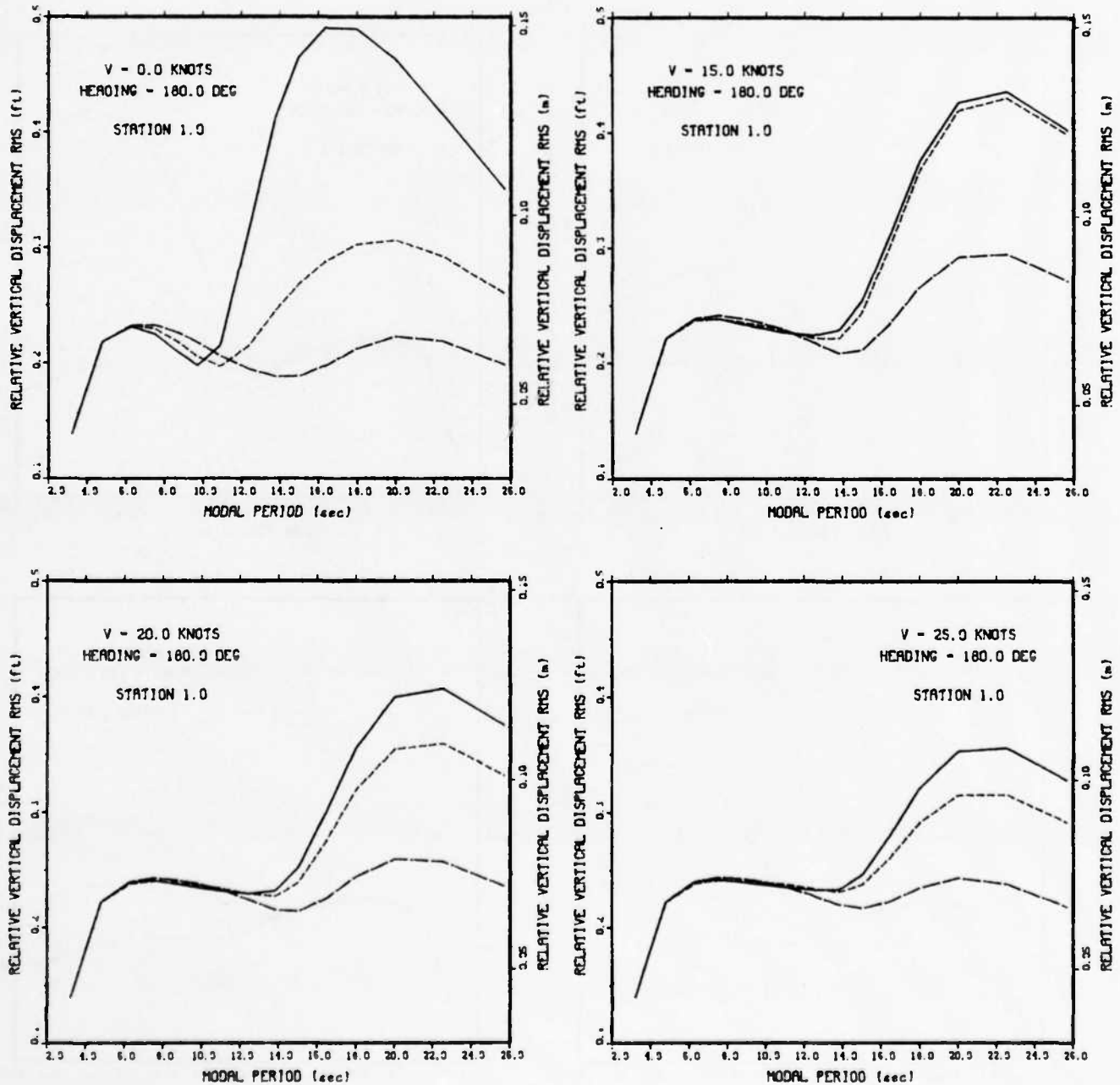


Figure 4c - Responses for Configurations 1131, 1132, and 1133

FIGURE 4 - CONTINUED

1211 —————
 1212 - - - - -
 1213 - - - - -

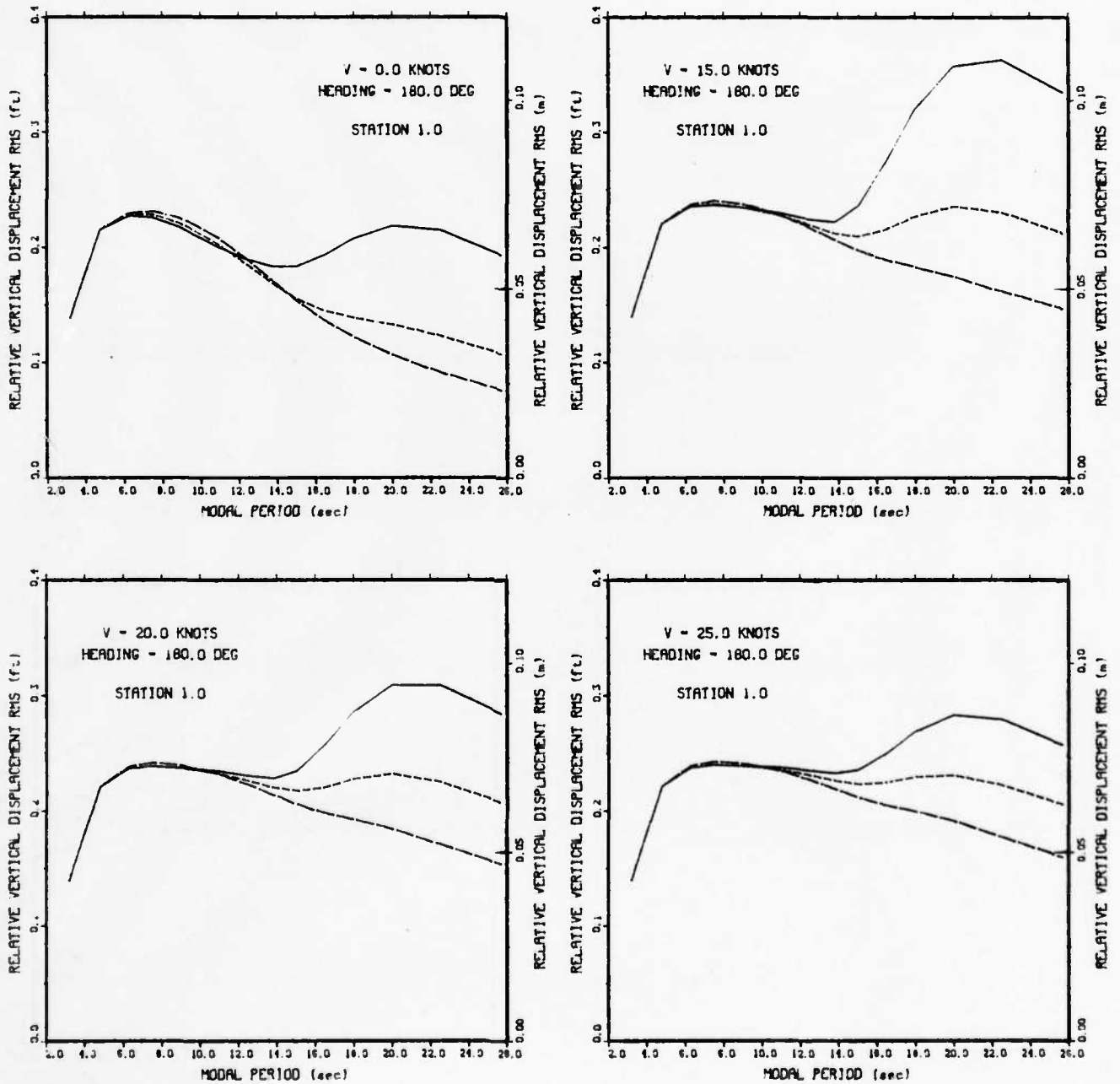


Figure 4d - Responses for Configurations 1211, 1212, and 1213

FIGURE 4 - CONTINUED

1221 —————
 1222 - - - - -
 1223 - · - · - ·

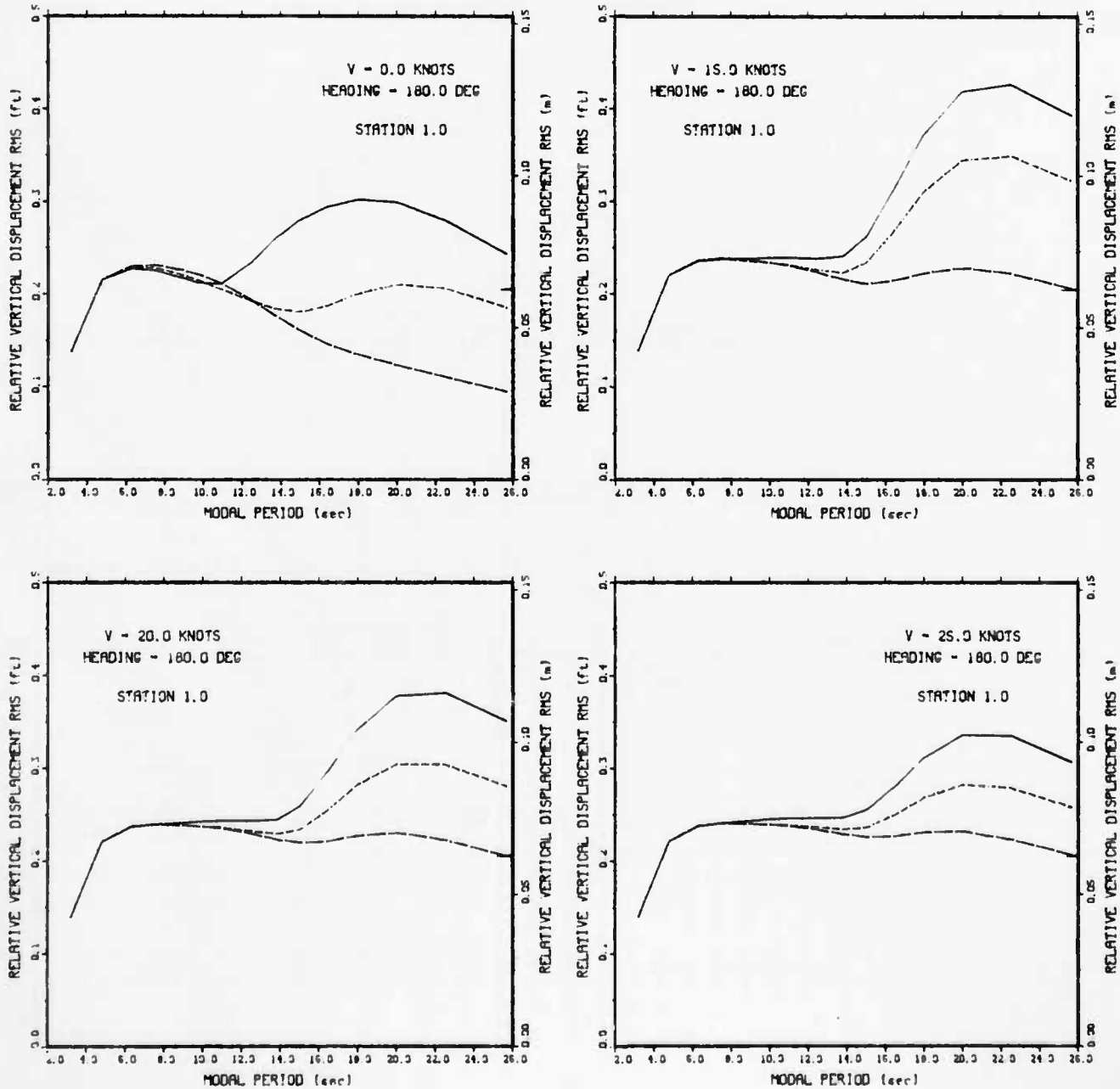


Figure 4e - Responses for Configurations 1221, 1222, and 1223

FIGURE 4 - CONTINUED

1231 —————
1232 - - - - -
1233 - - - - -

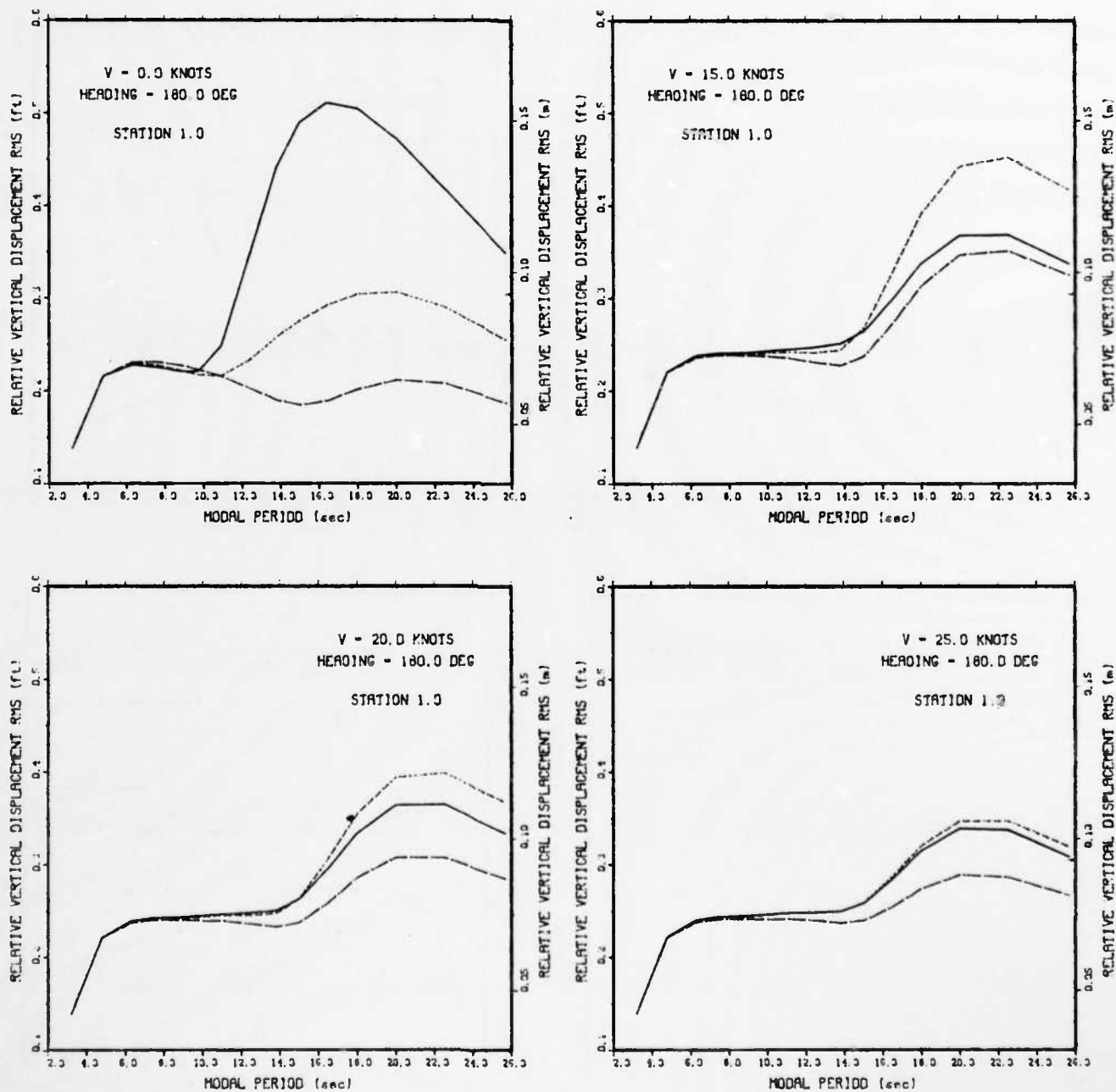


Figure 4f - Responses for Configurations 1231, 1232, and 1233

FIGURE 4 - CONTINUED

1311 —————
 1312 - - - - -
 1313 - - - - -

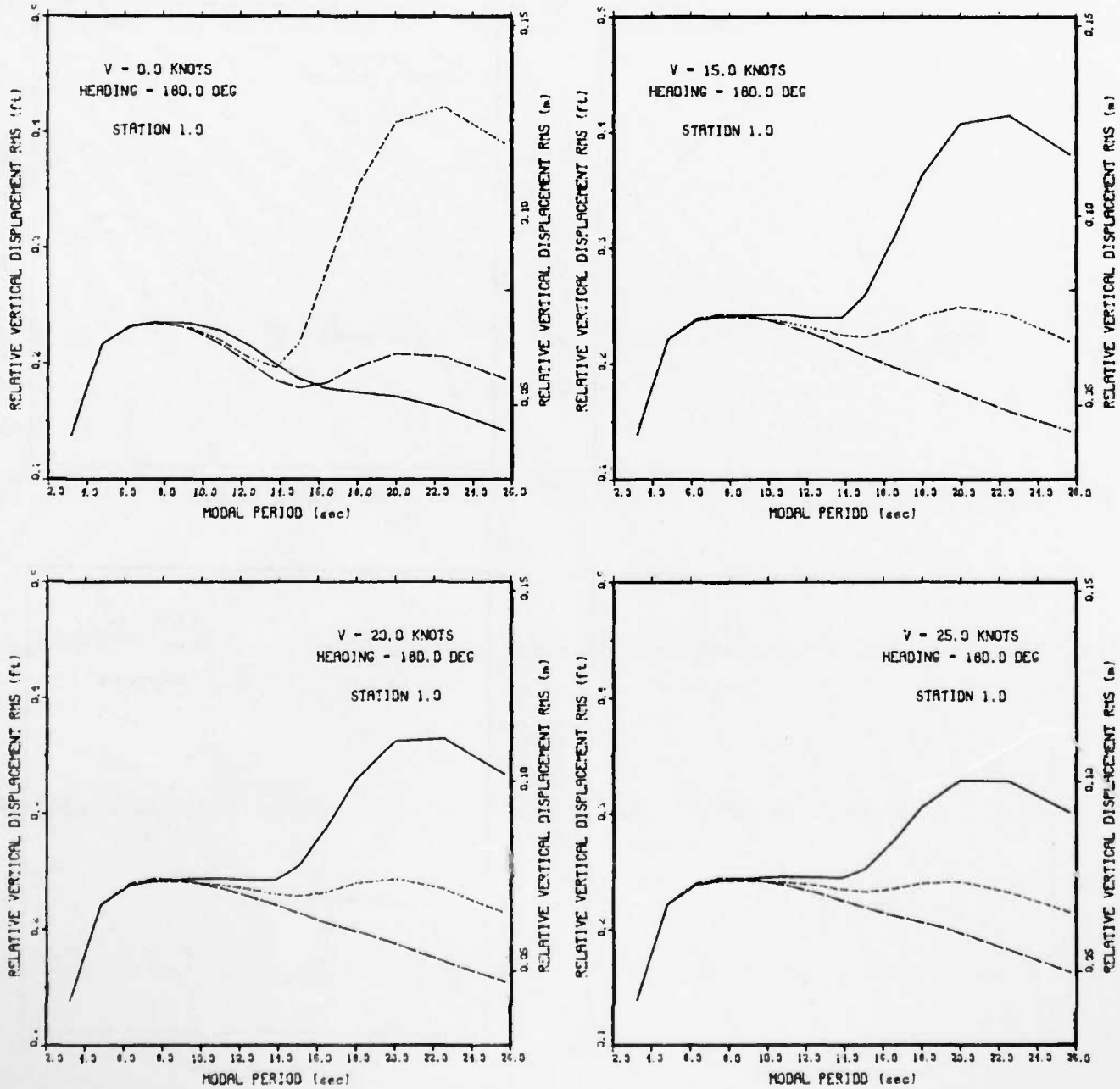


Figure 4g - Responses for Configurations 1311, 1312, and 1313

FIGURE 4 - CONTINUED

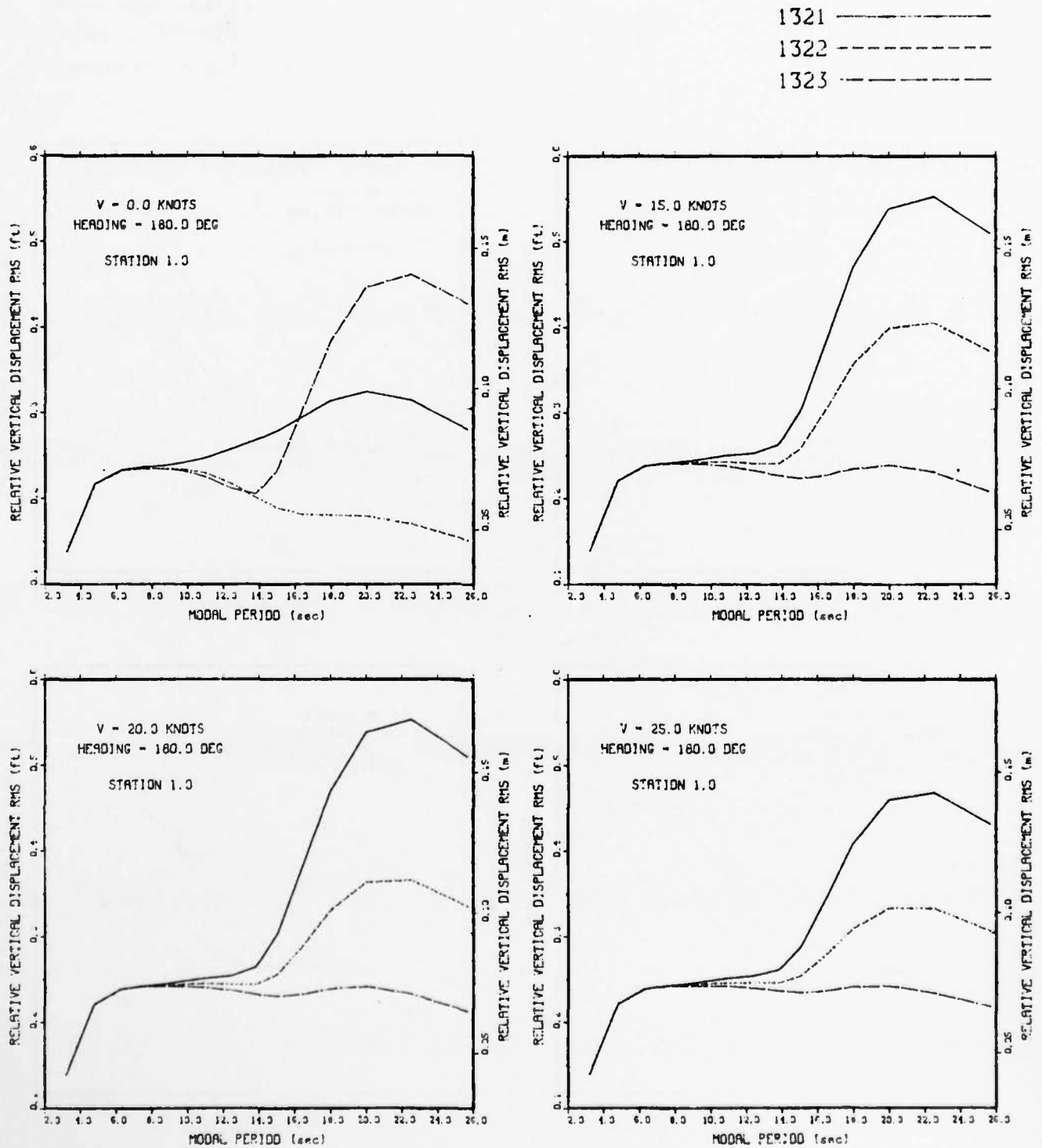


Figure 4h - Responses for Configurations 1321, 1322, and 1323

FIGURE 4 - CONTINUED

1331 —————
 1332 - - - - -
 1333 - - - - -

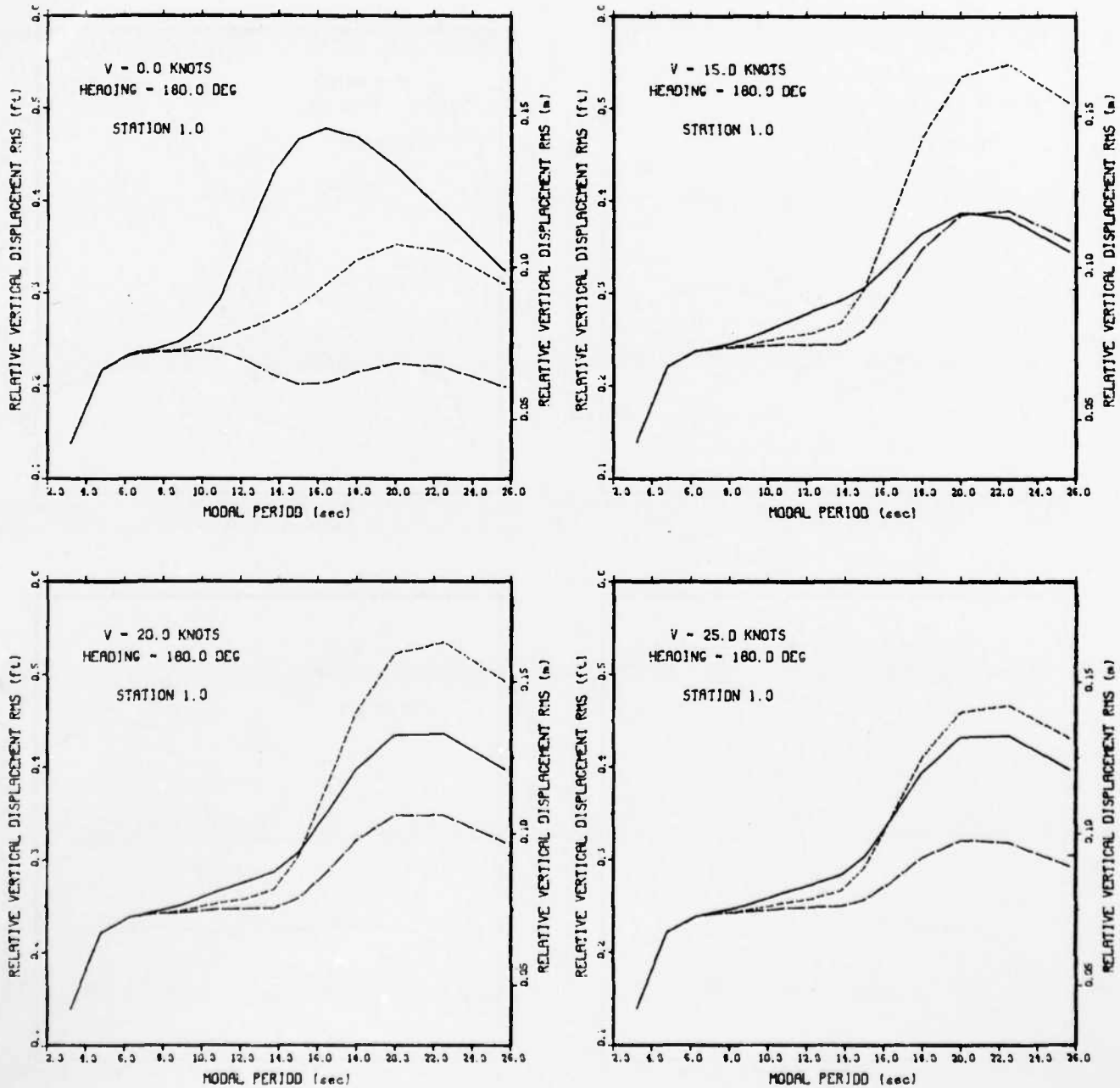


Figure 4i - Responses for Configurations 1331, 1332, and 1333

FIGURE 4 - CONTINUED

2111 —————
 2112 - - - - -
 2113 - - - - -

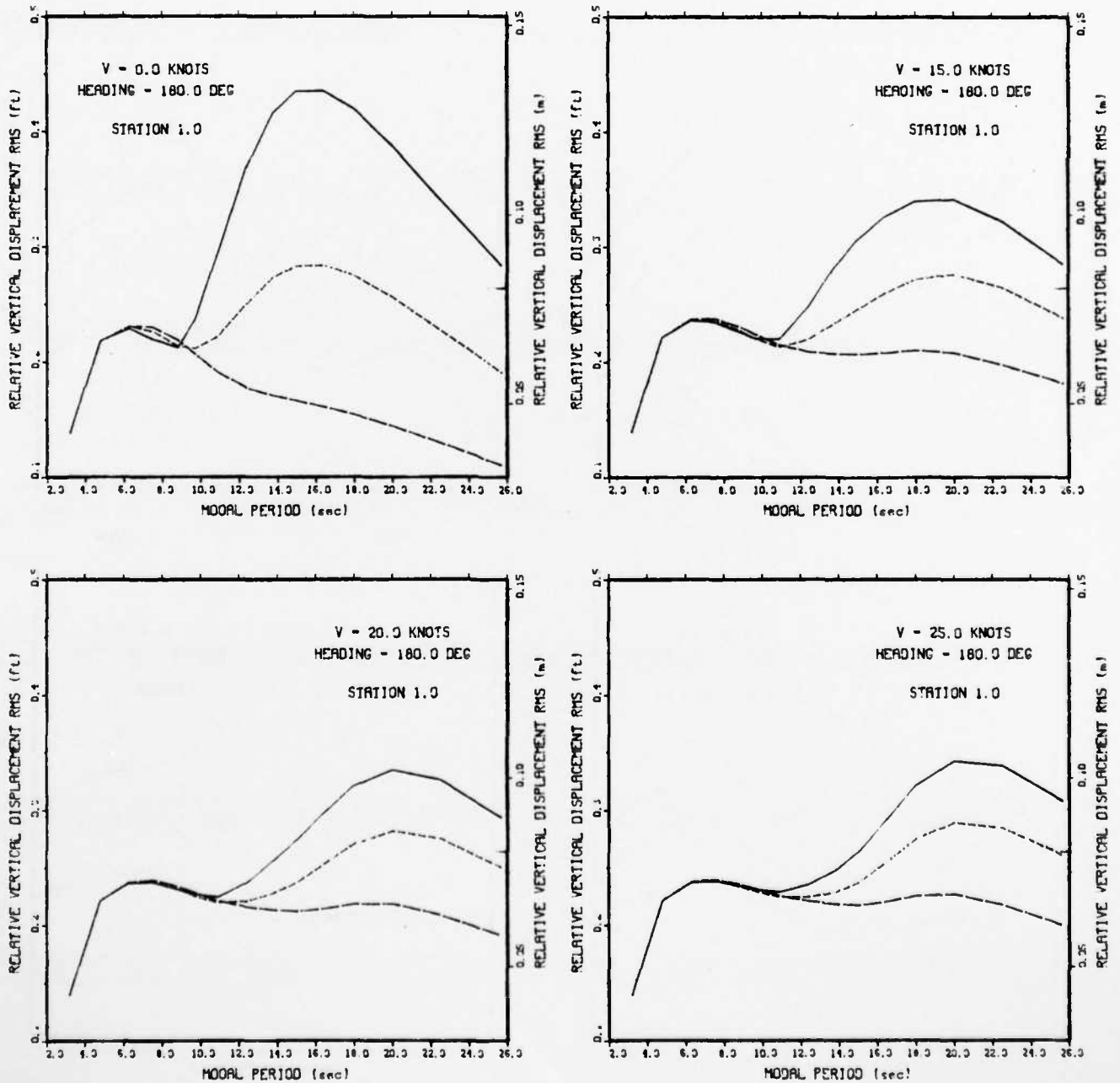


Figure 4j - Responses for Configurations 2111, 2112, and 2113

FIGURE 4 - CONTINUED

2121 —————
 2122 - - - - -
 2123 - · - · -

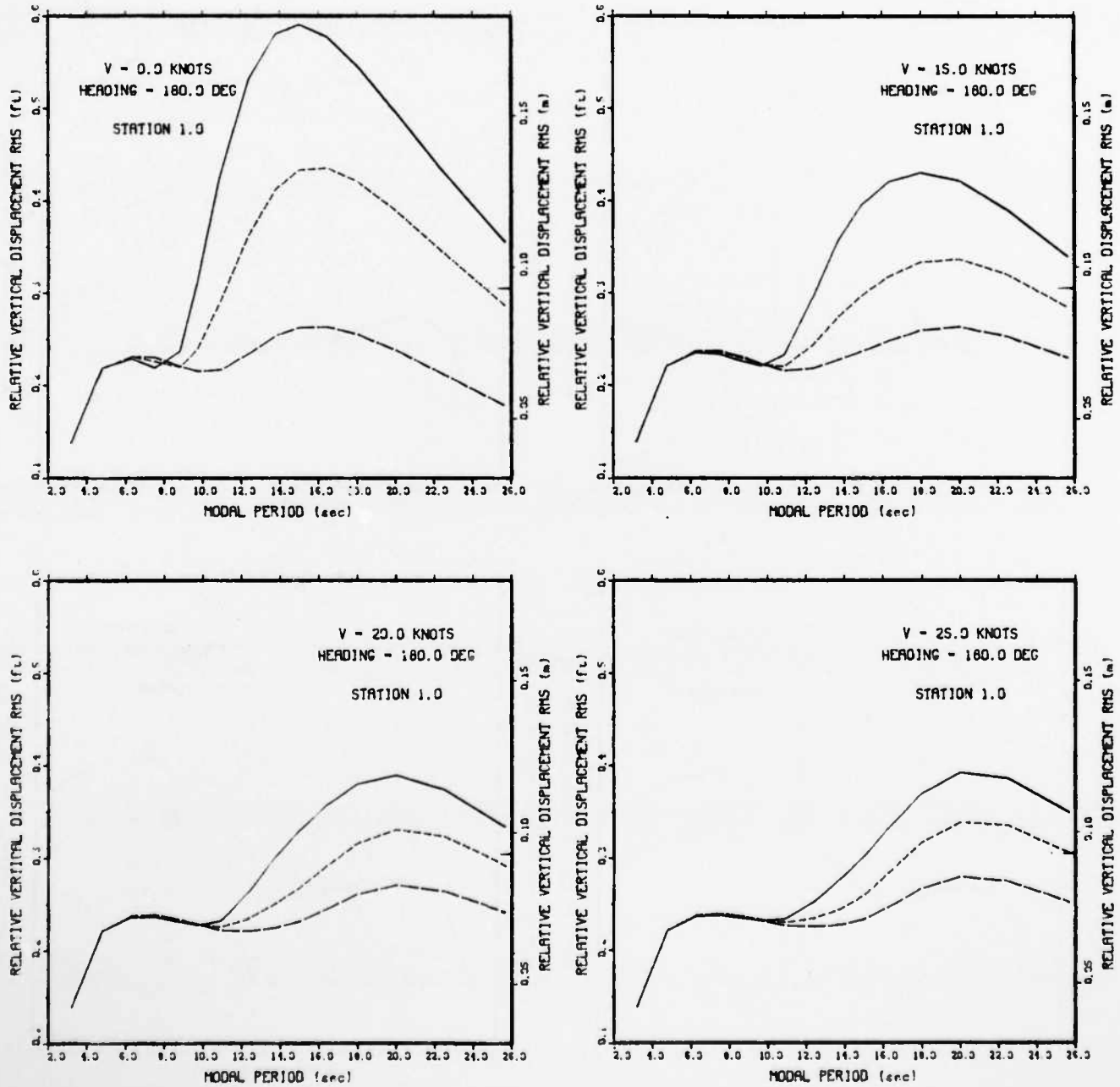


Figure 4k - Responses for Configurations 2121, 2122, and 2123

FIGURE 4 - CONTINUED

2132 - - - - -
2133 - - - - -

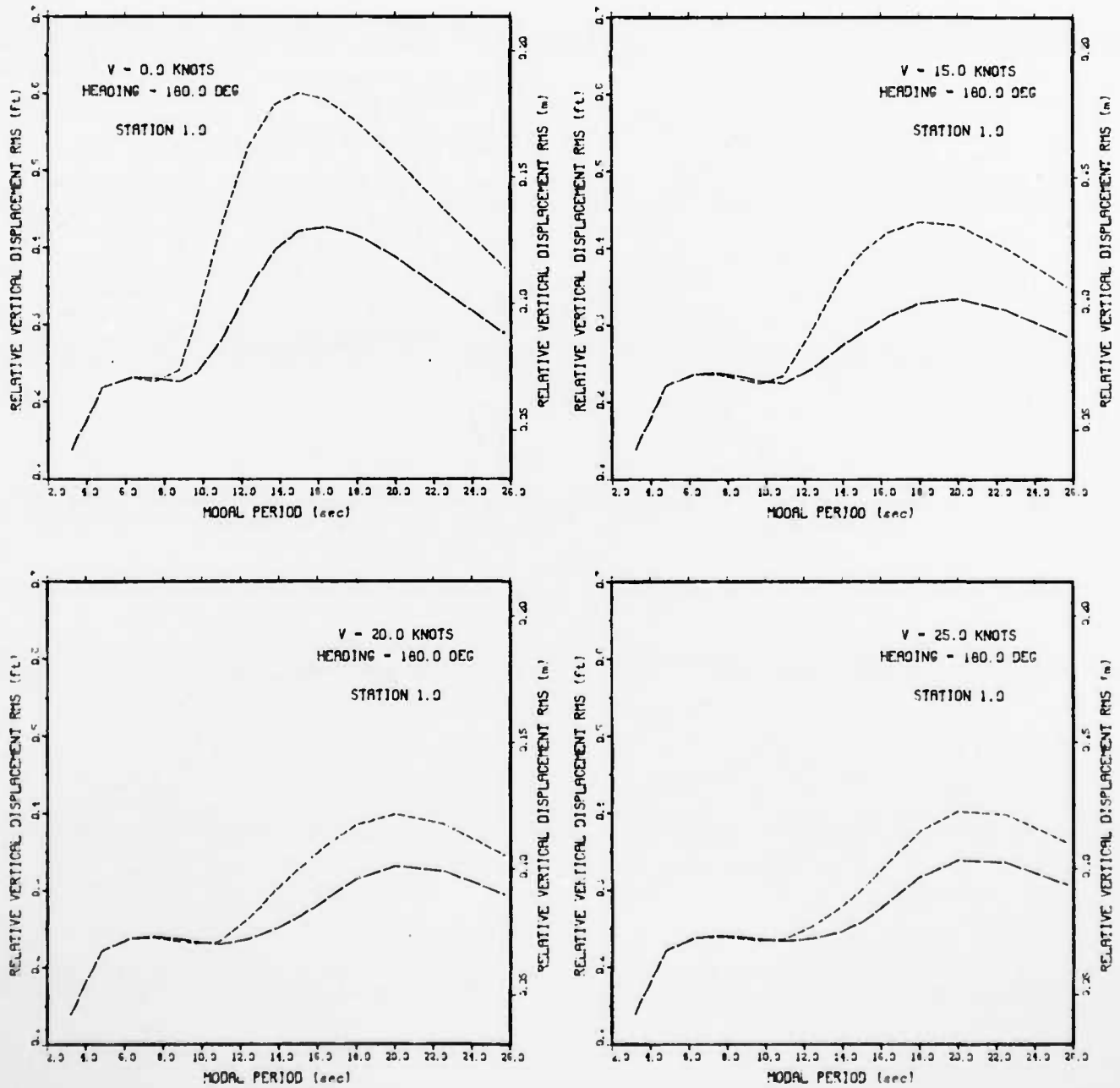


Figure 41 - Responses for Configurations 2132 and 2133

FIGURE 4 - CONTINUED

2211 —————
 2212 - - - - -
 2213 - - - - -

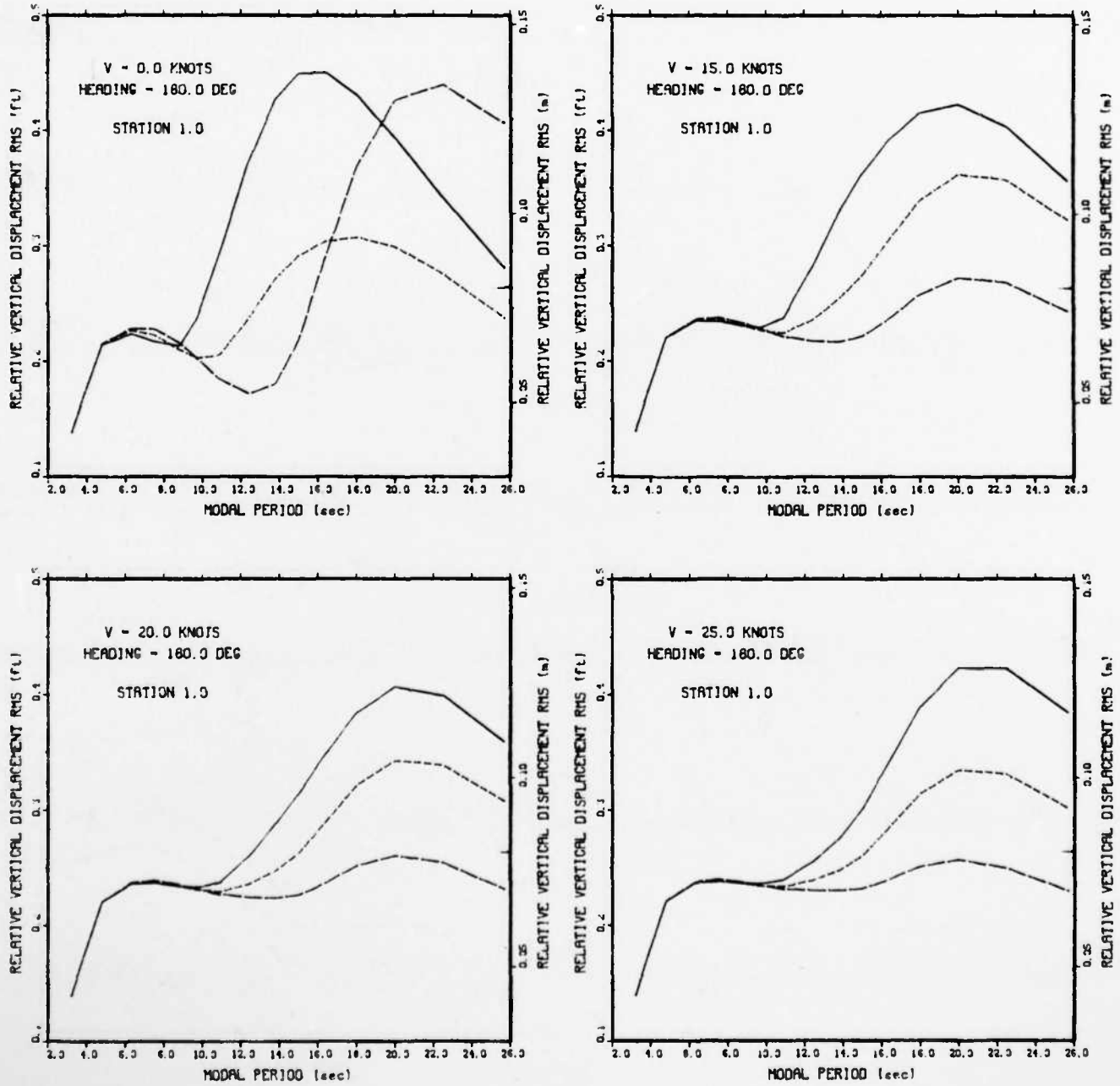


Figure 4m - Responses for Configurations 2211, 2212, and 2213

FIGURE 4 - CONTINUED

2221 ———
2222 - - -
2223 - - -

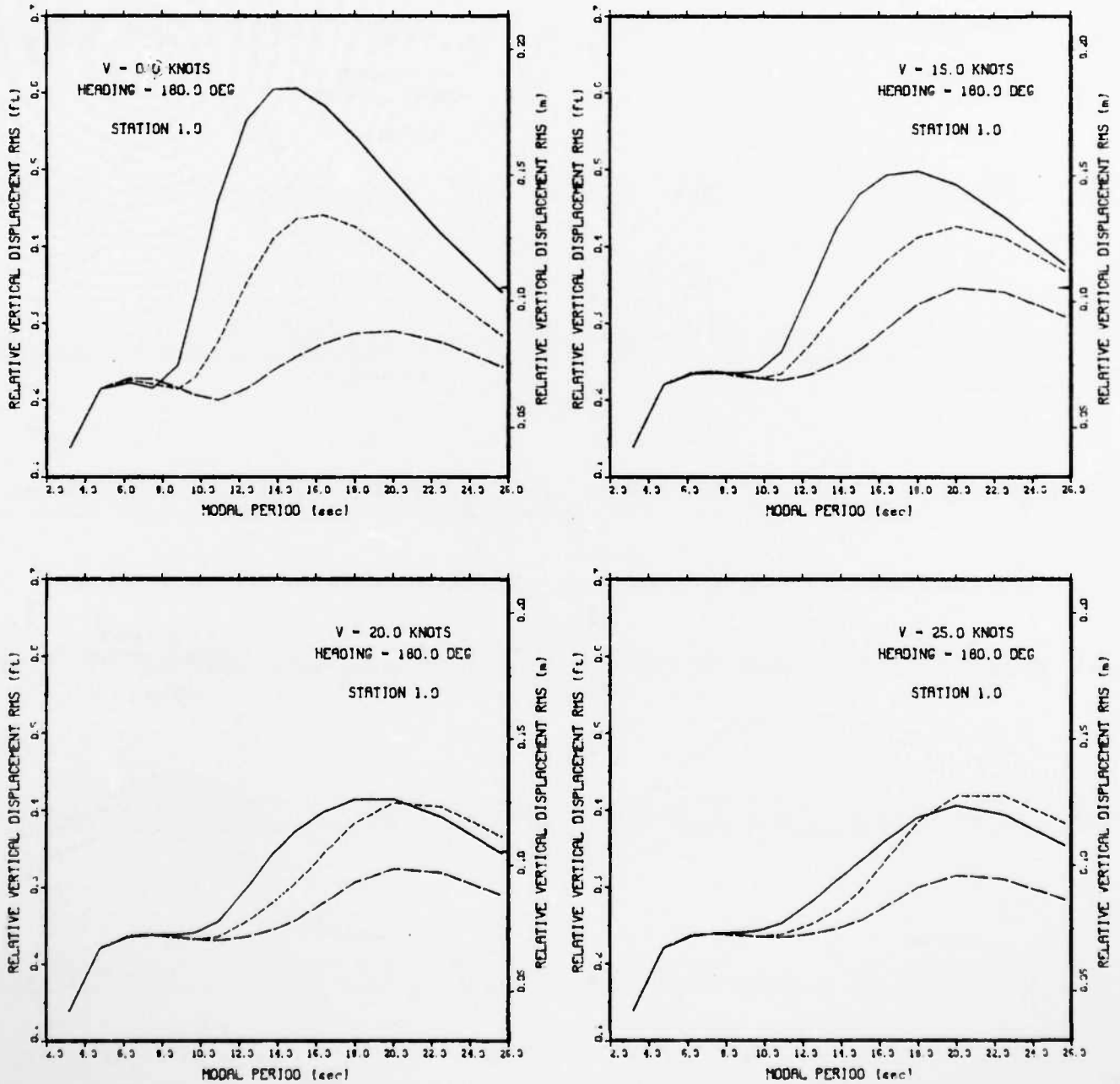


Figure 4n - Responses for Configurations 2221, 2222, and 2223

FIGURE 4 - CONTINUED

2231 —————
 2232 - - - - -
 2233 - - - - -

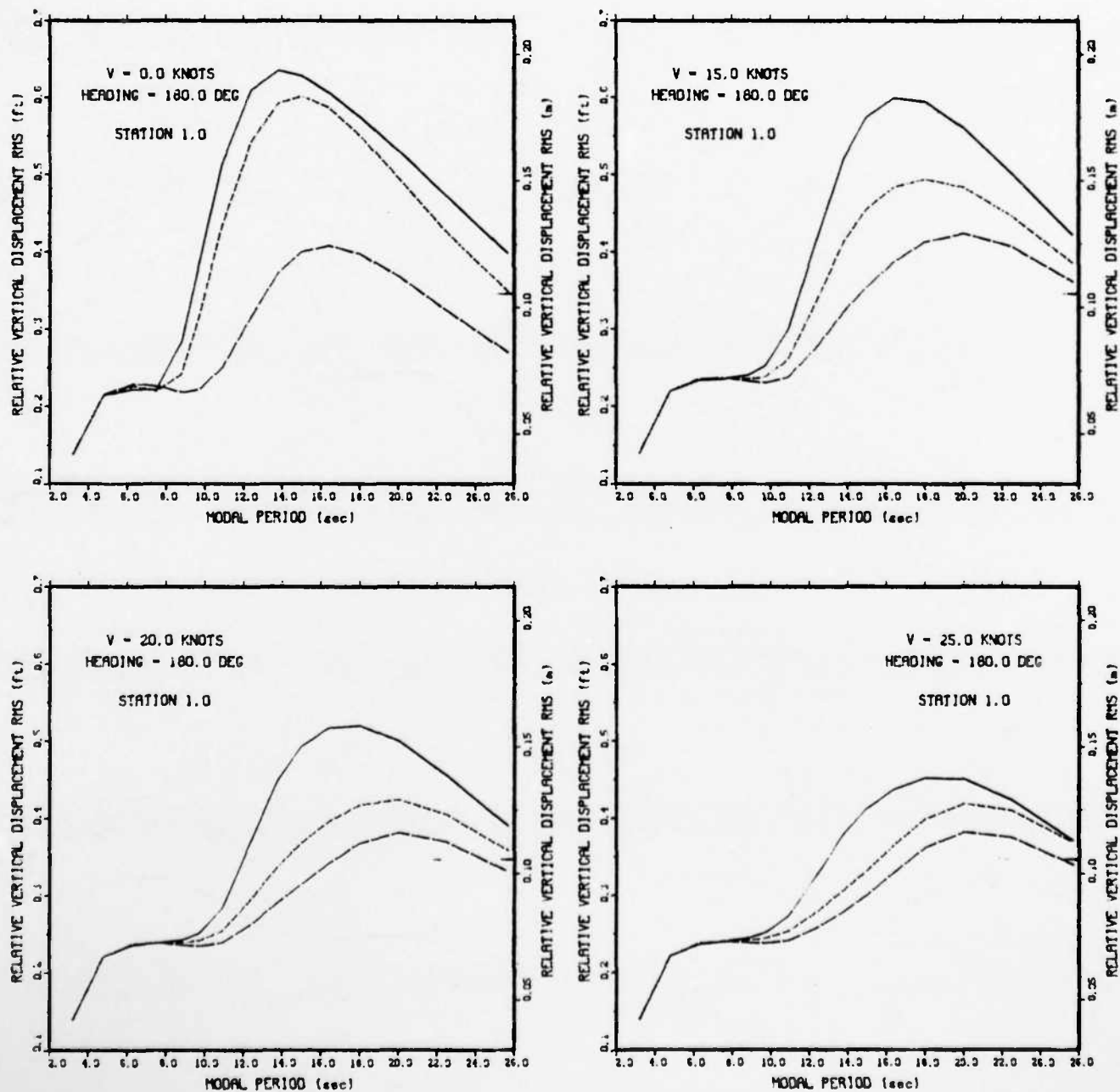


Figure 4a - Responses for Configurations 2231, 2232, and 2233

FIGURE 4 - CONTINUED

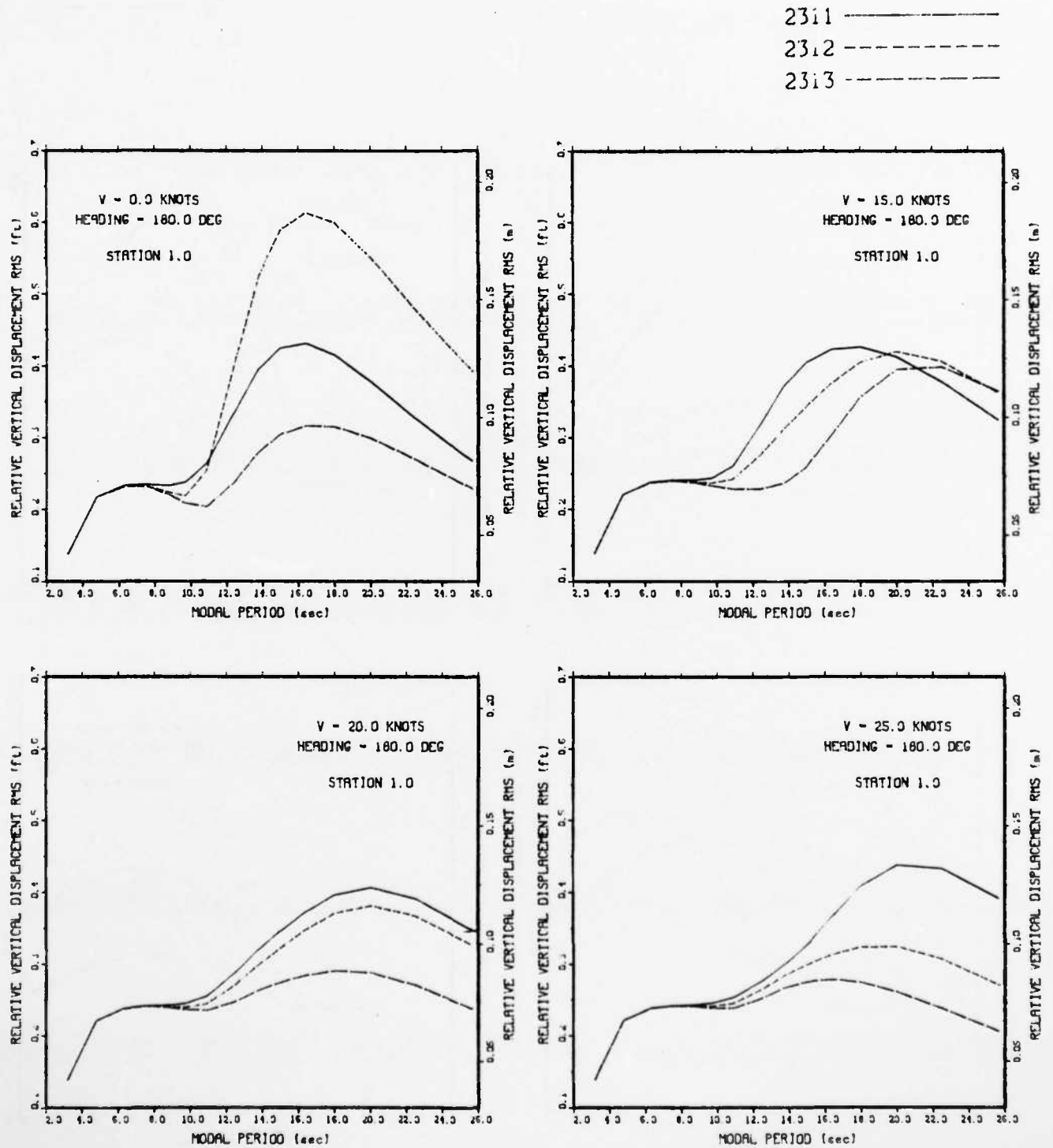


Figure 4p - Responses for Configurations 2311, 2312, and 2313

FIGURE 4 - CONTINUED

2321 —————
 2322 - - - - -
 2323 -

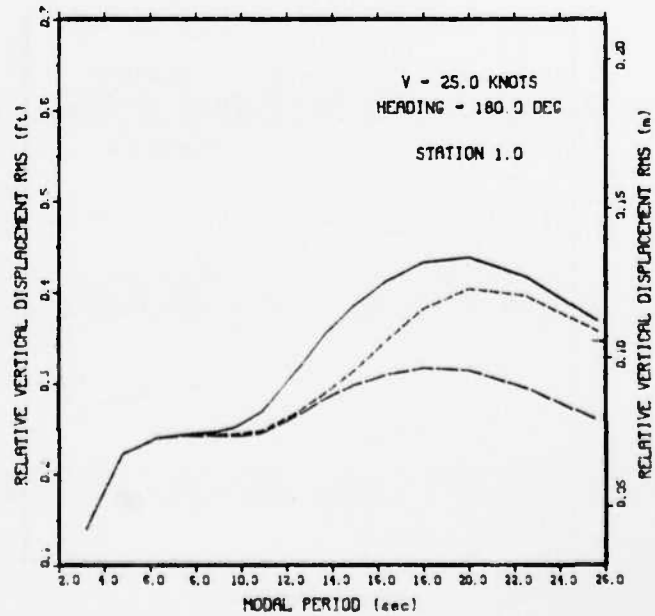
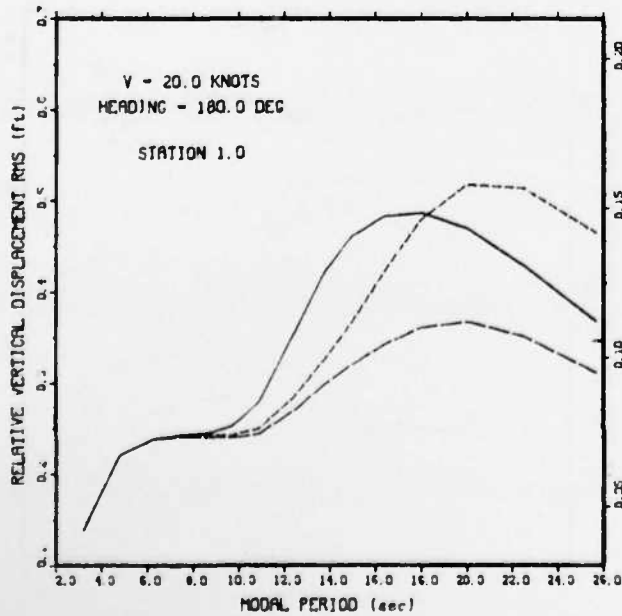
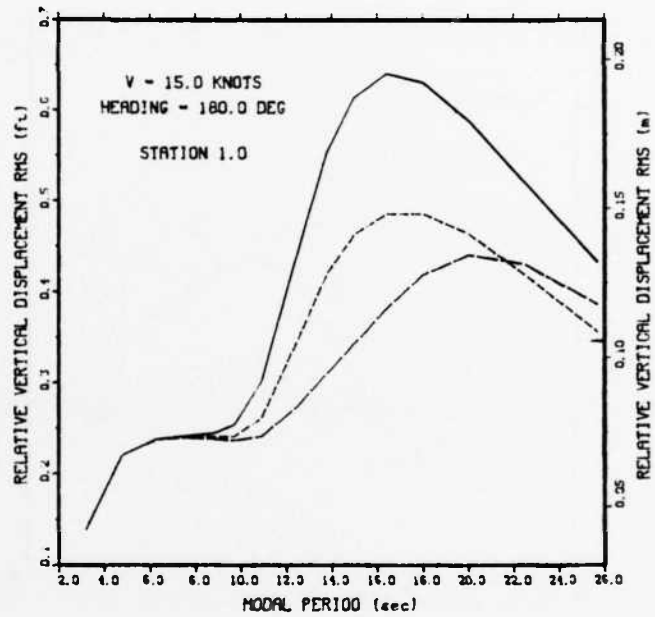
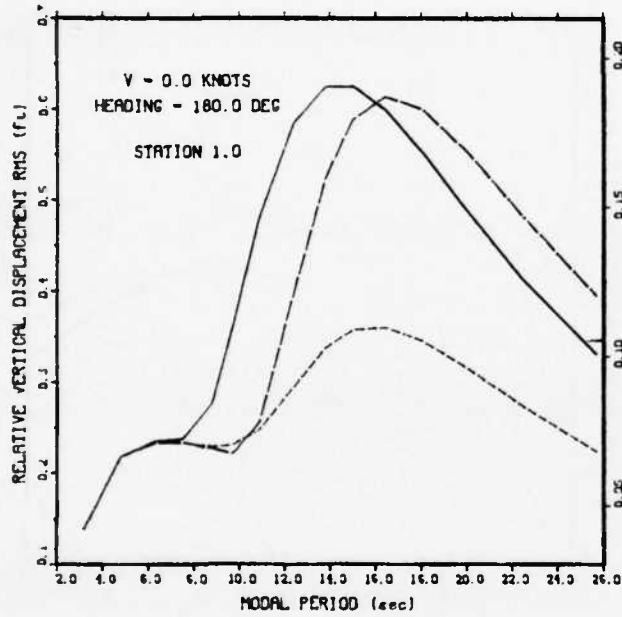


Figure 4q - Responses for Configurations 2321, 2322, and 2323

FIGURE 4 - CONTINUED

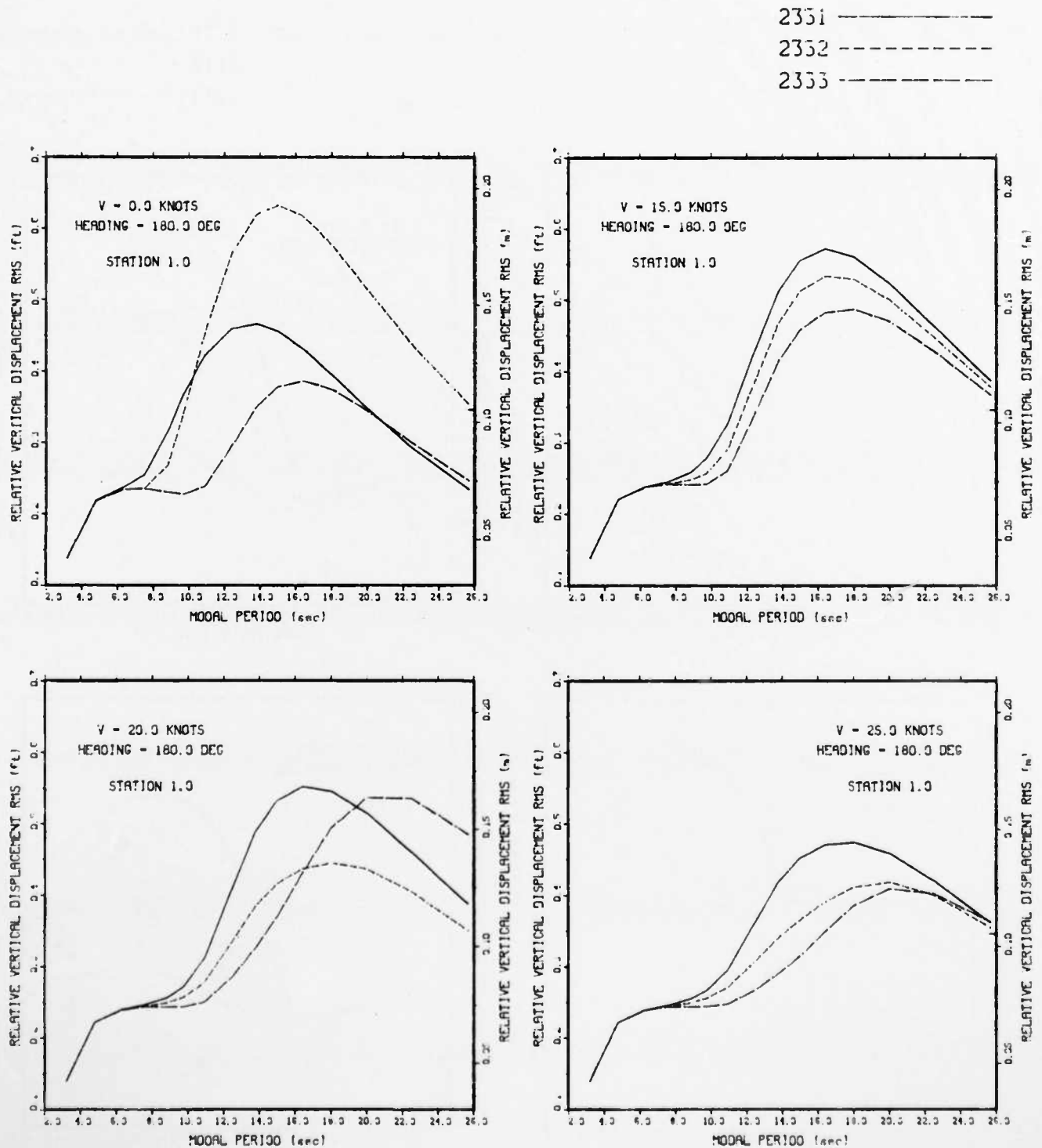


Figure 4r - Responses for Configurations 2331, 2332, and 2333

FIGURE 4 - CONTINUED

3111 —————
 3112 - - - - -
 3113 -

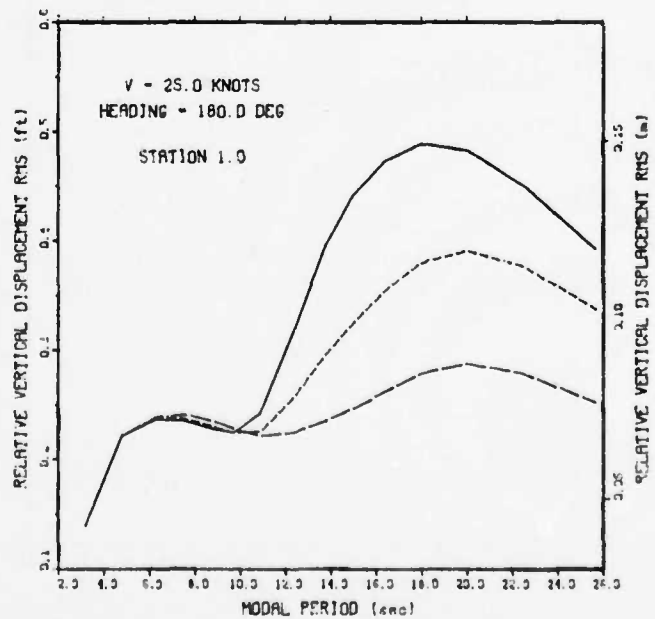
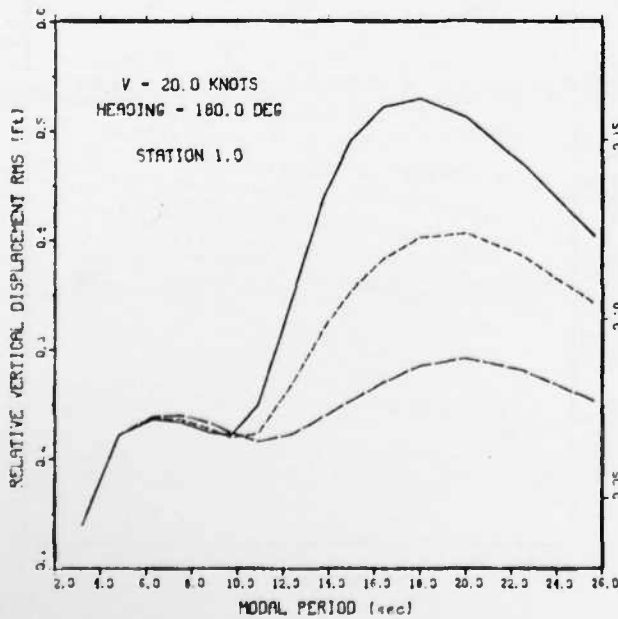
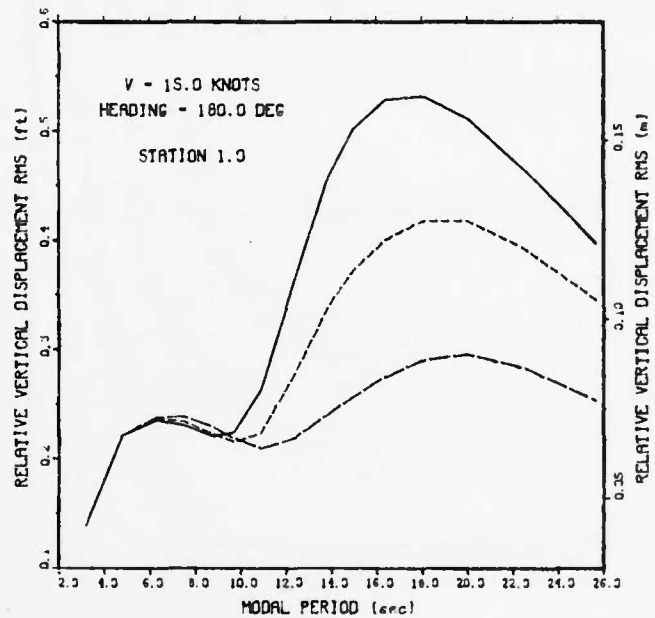
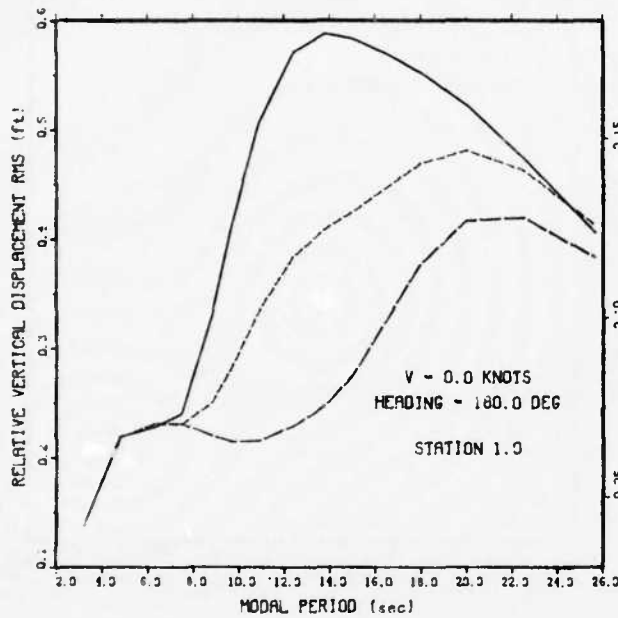


Figure 4s - Responses for Configurations 3111, 3112, and 3113

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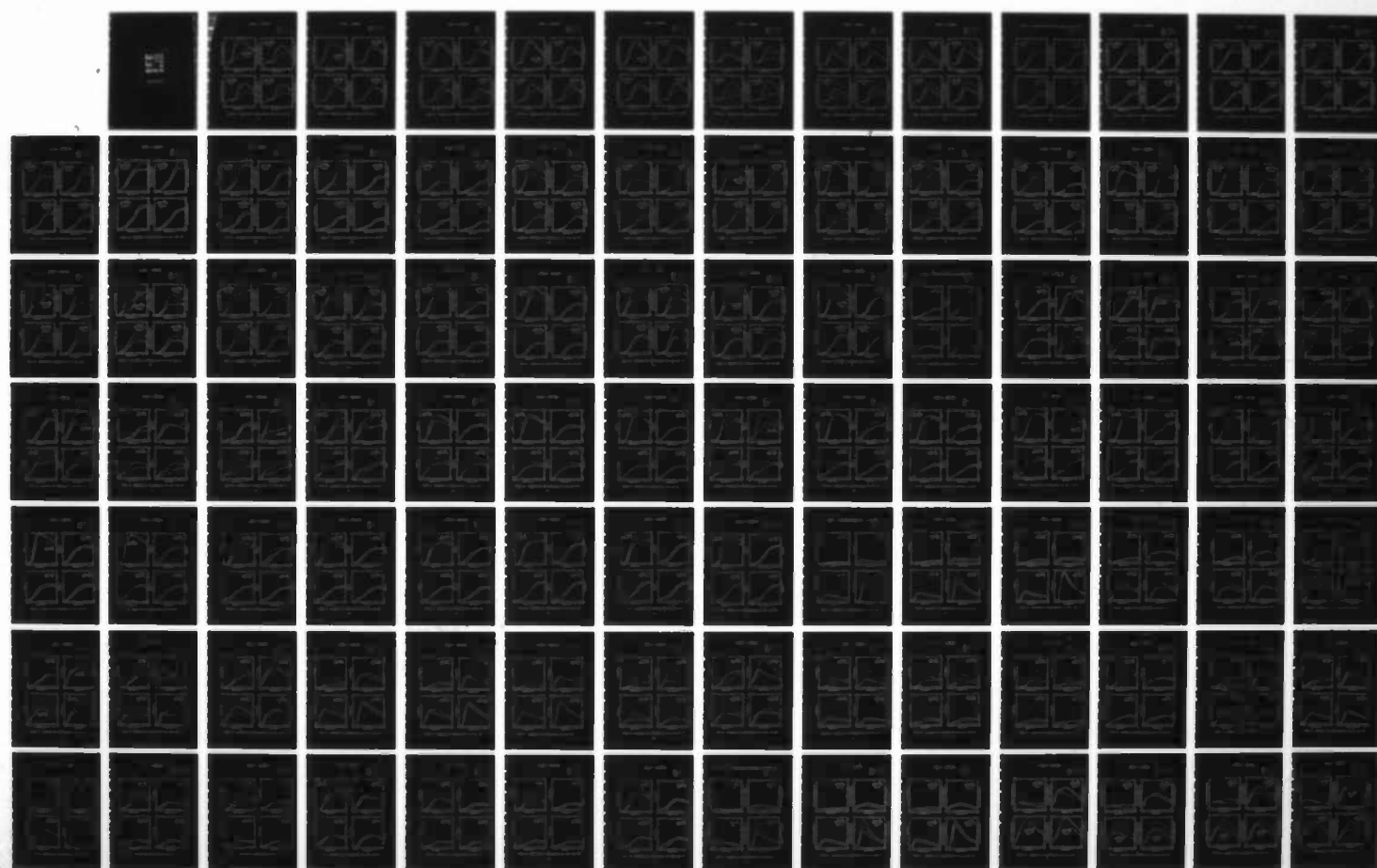
2/3

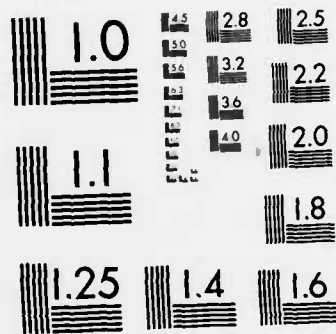
UNCLASSIFIED

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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

FIGURE 4 - CONTINUED

3121 -----
3122 -----
3123 -----

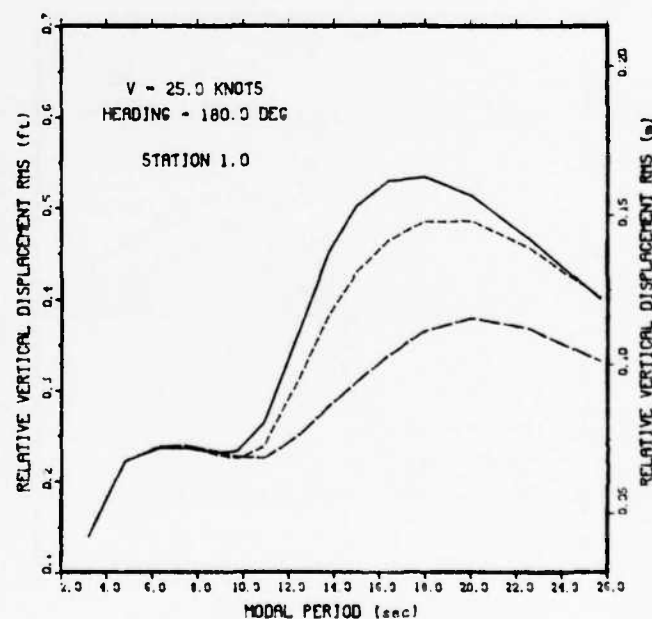
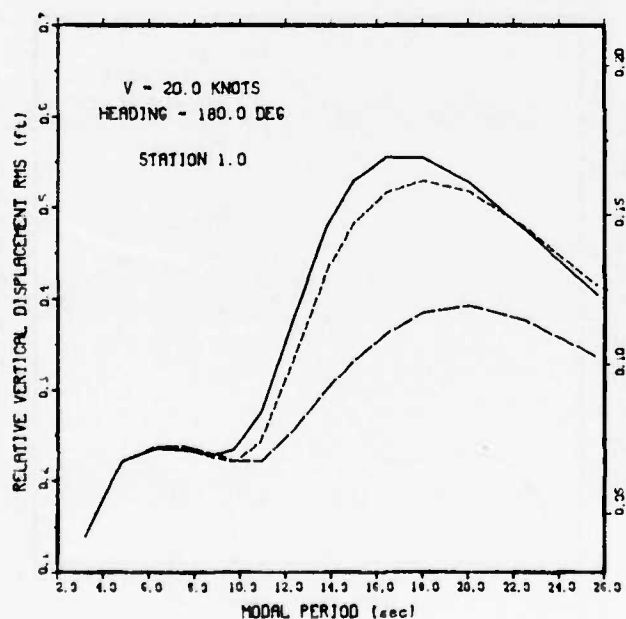
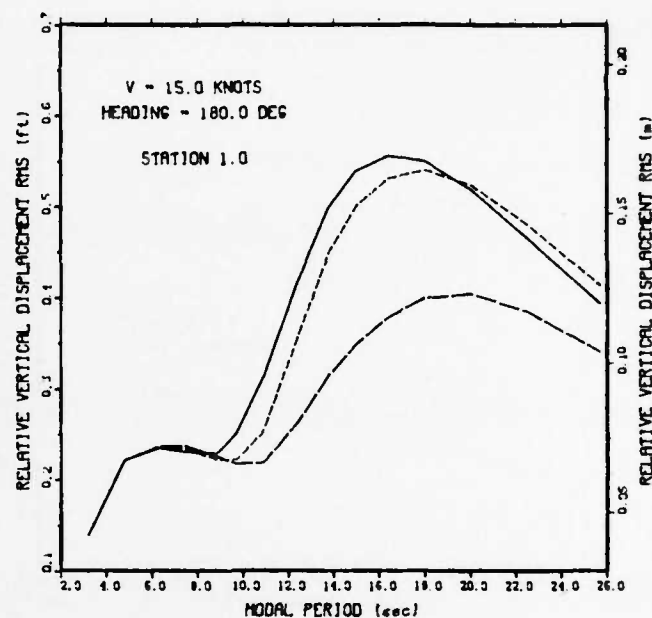
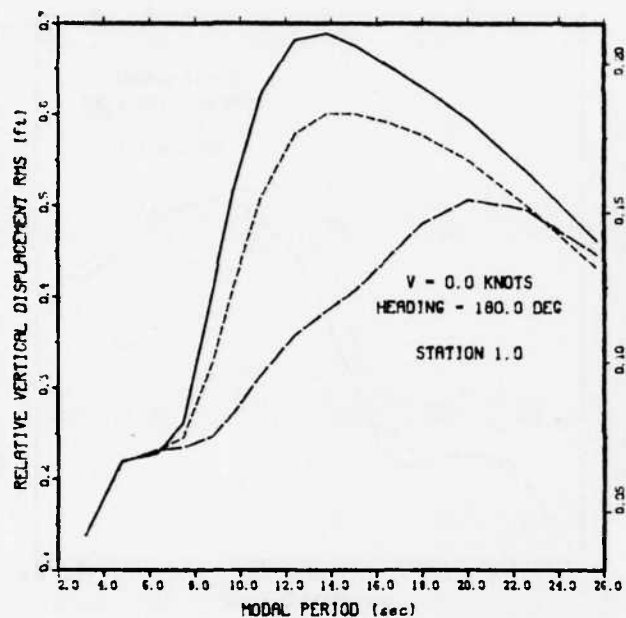


Figure 4t - Responses for Configurations 3121, 3122, and 3123

FIGURE 4 - CONTINUED

3132 -----
3133 - - - - -

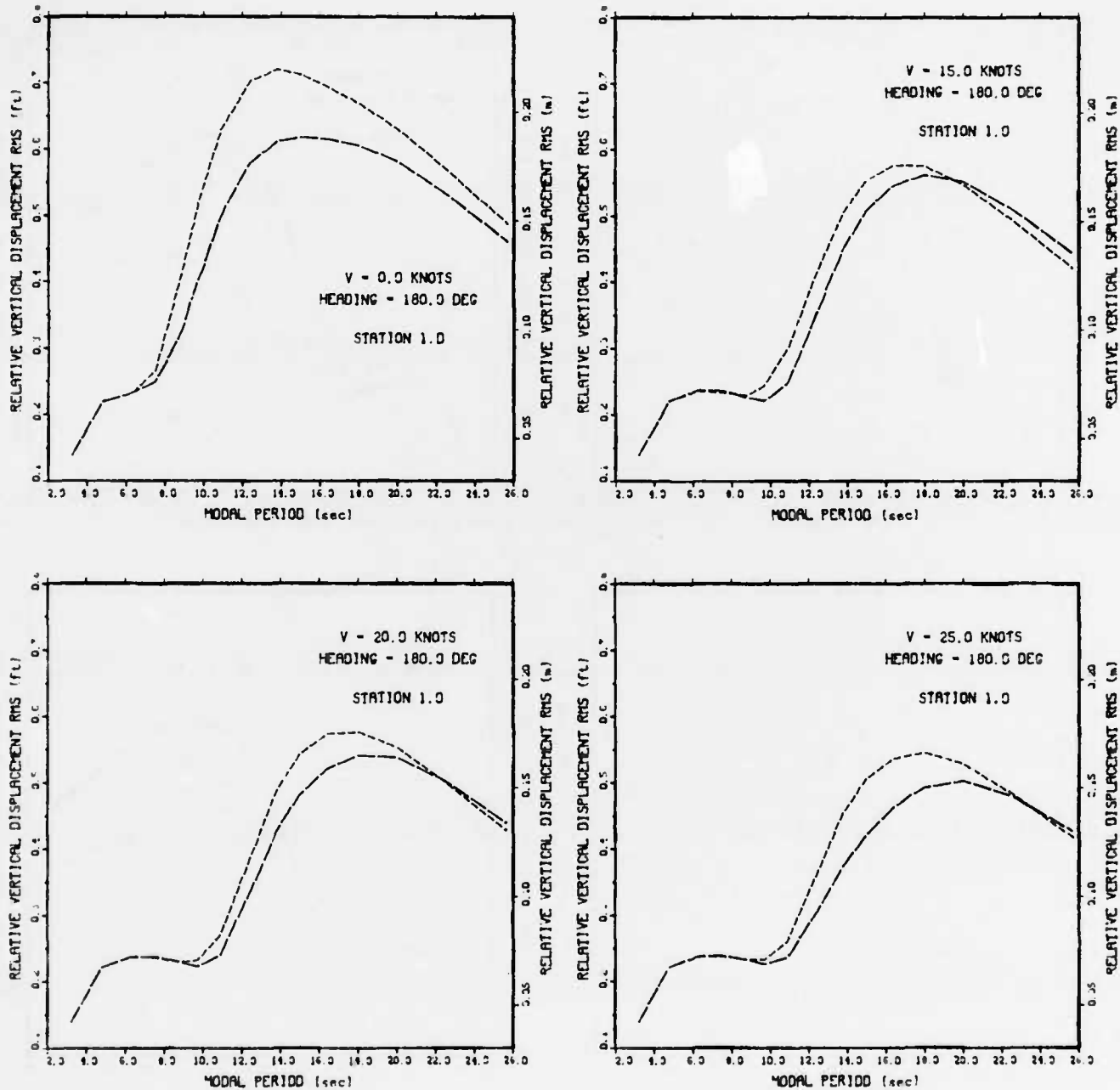


Figure 4u - Responses for Configurations 3132 and 3133

FIGURE 4 - CONTINUED

3211 -----
3212 - - - - -
3213 - - - - -

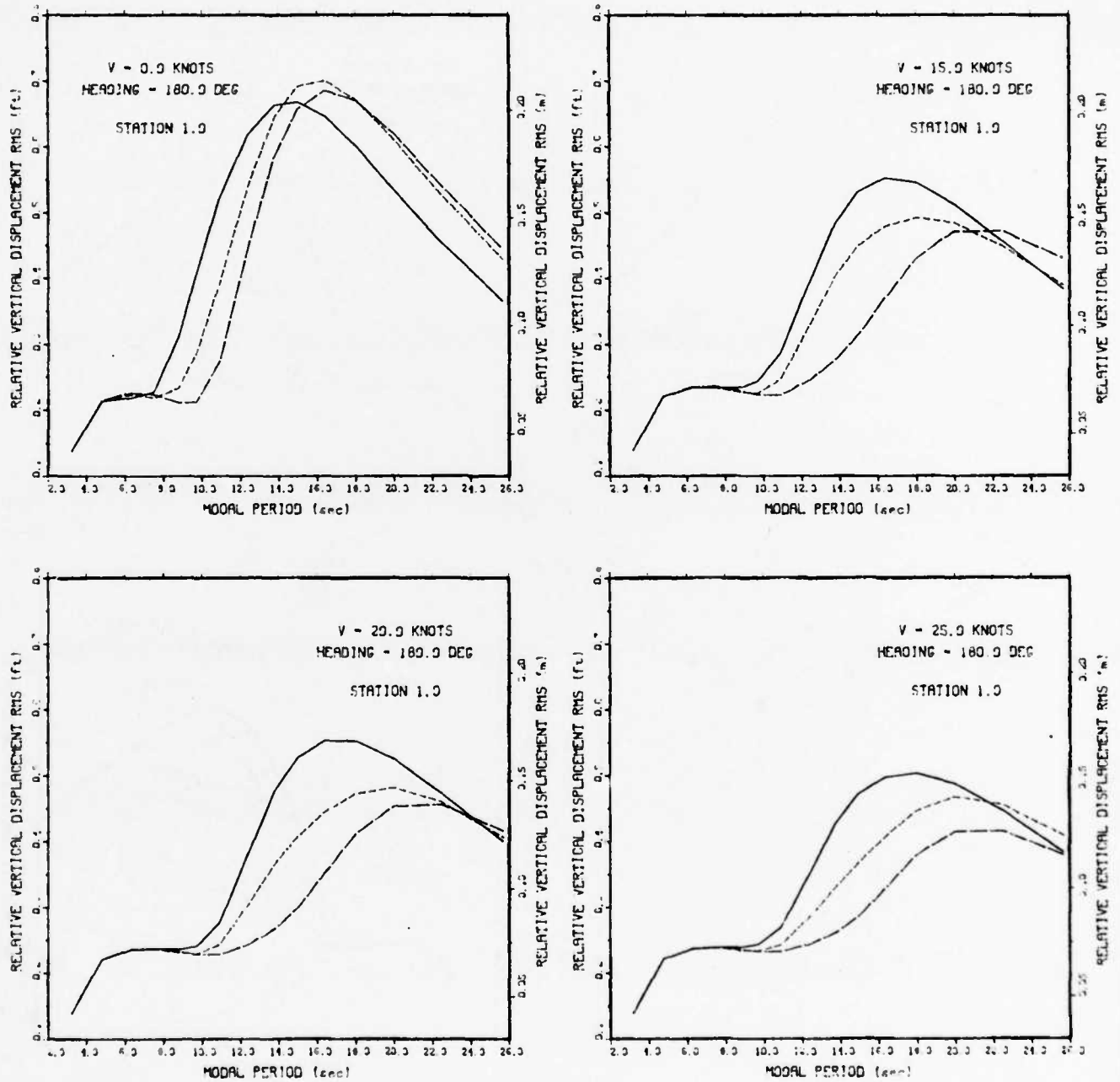


Figure 4v - Responses for Configurations 3211, 3212, and 3213

FIGURE 4 - CONTINUED

3221 ———
3222 - - -
3223 - - -

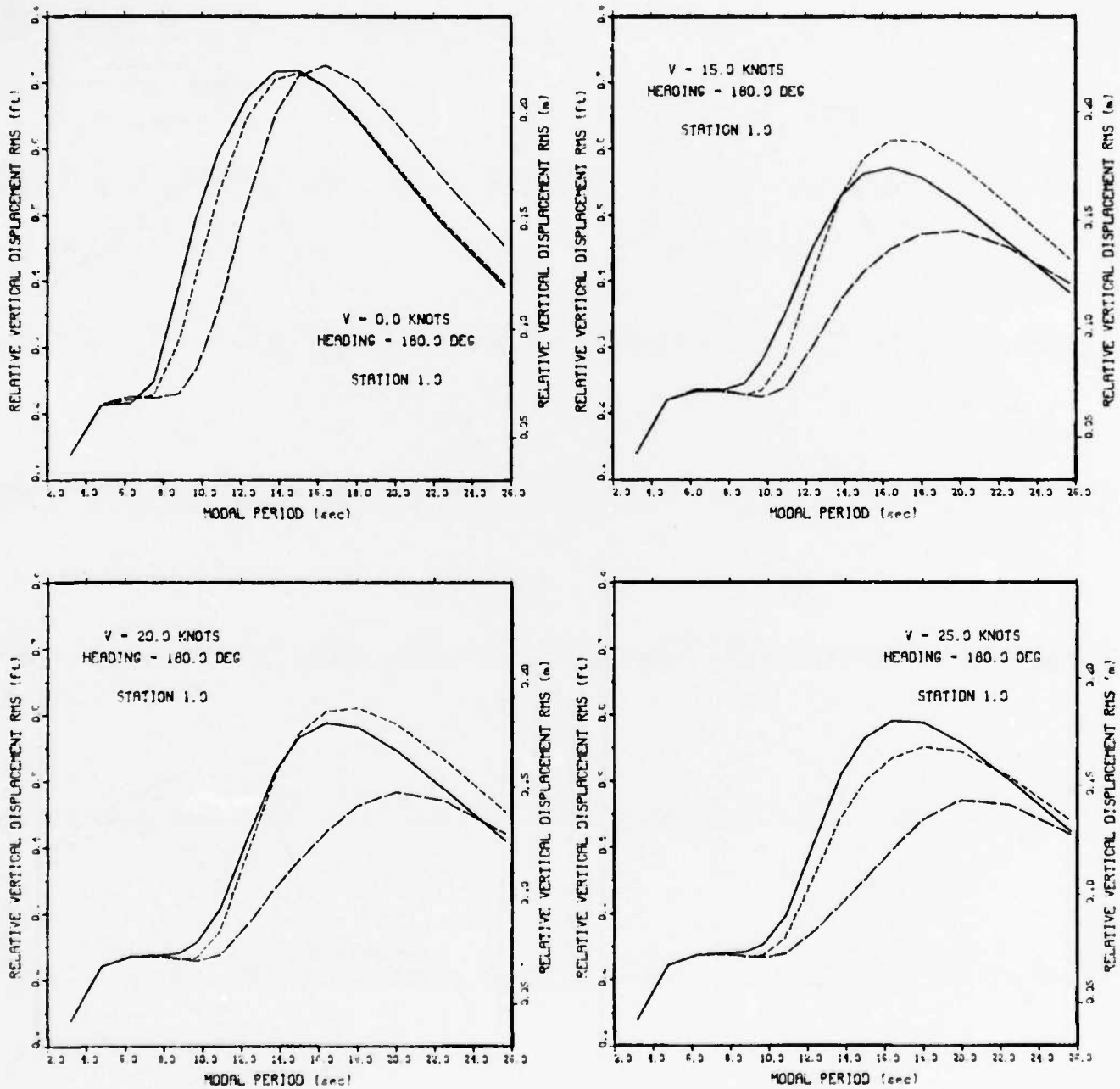


Figure 4w - Responses for Configurations 3221, 3222, and 3223

FIGURE 4 - CONTINUED

3231 ———
3232 - - -
3233 - - -

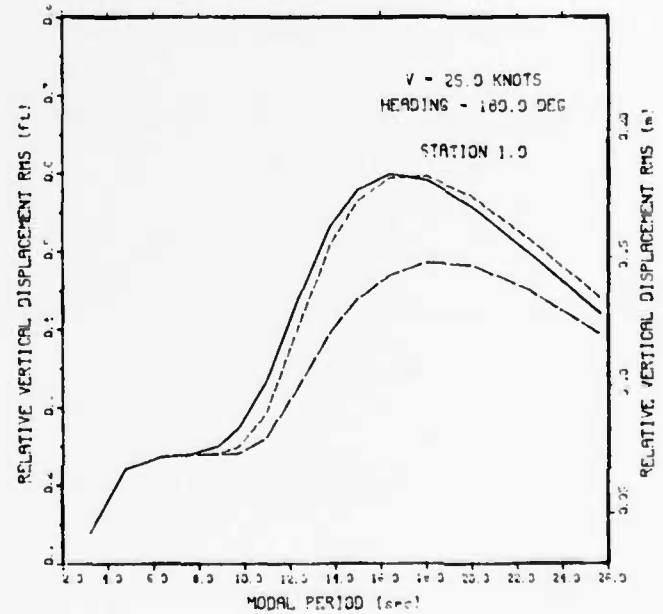
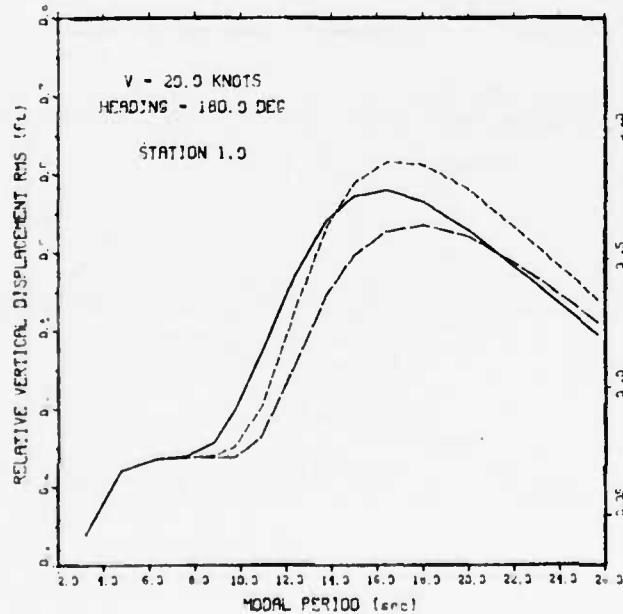
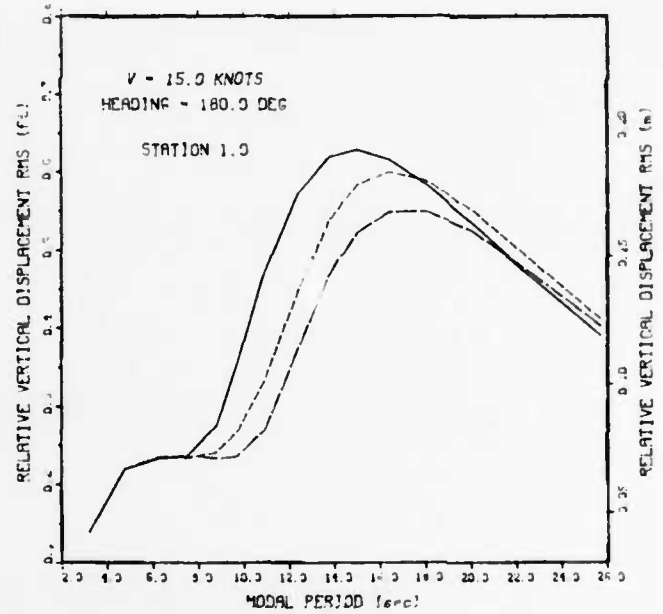
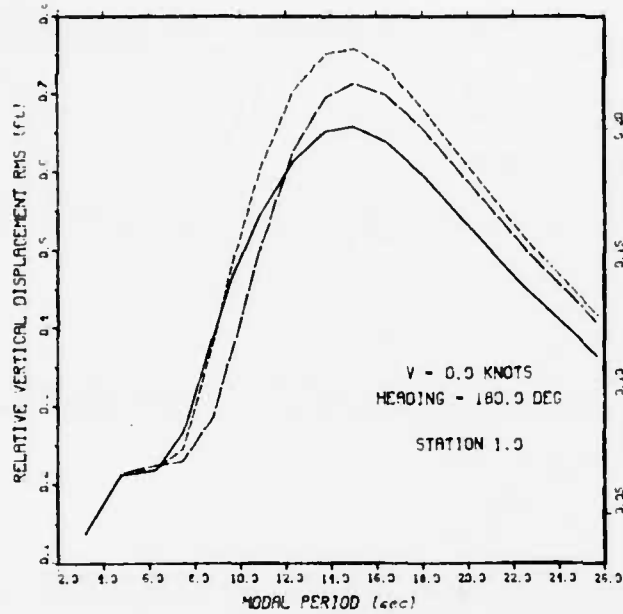


Figure 4x - Responses for Configurations 3231, 3232, and 3233

FIGURE 4 - CONTINUED

3311 —————
 3312 - - - - -
 3313 - - - - -

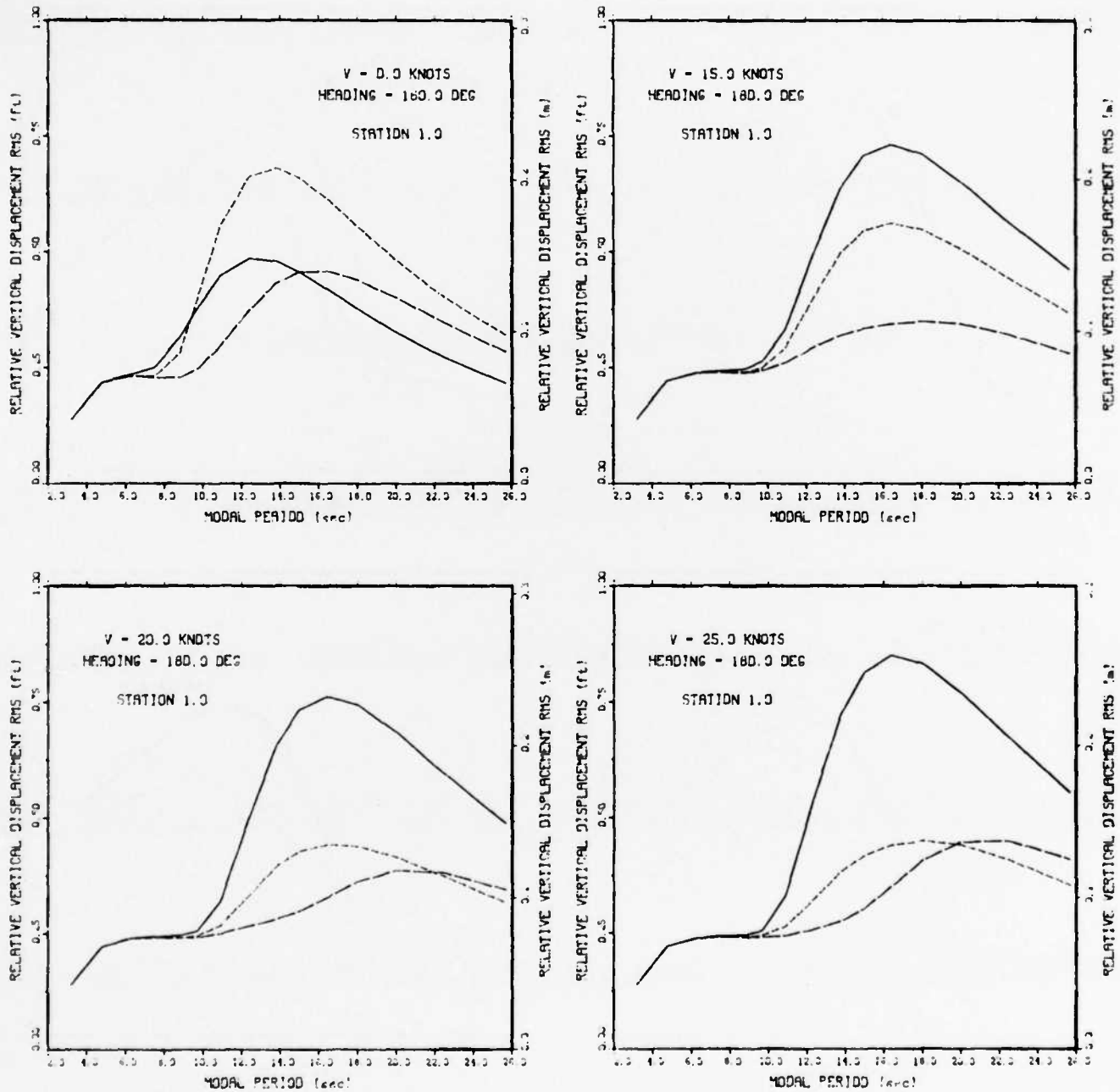


Figure 4y - Responses for Configurations 3311, 3312, and 3313

FIGURE 4 - CONTINUED

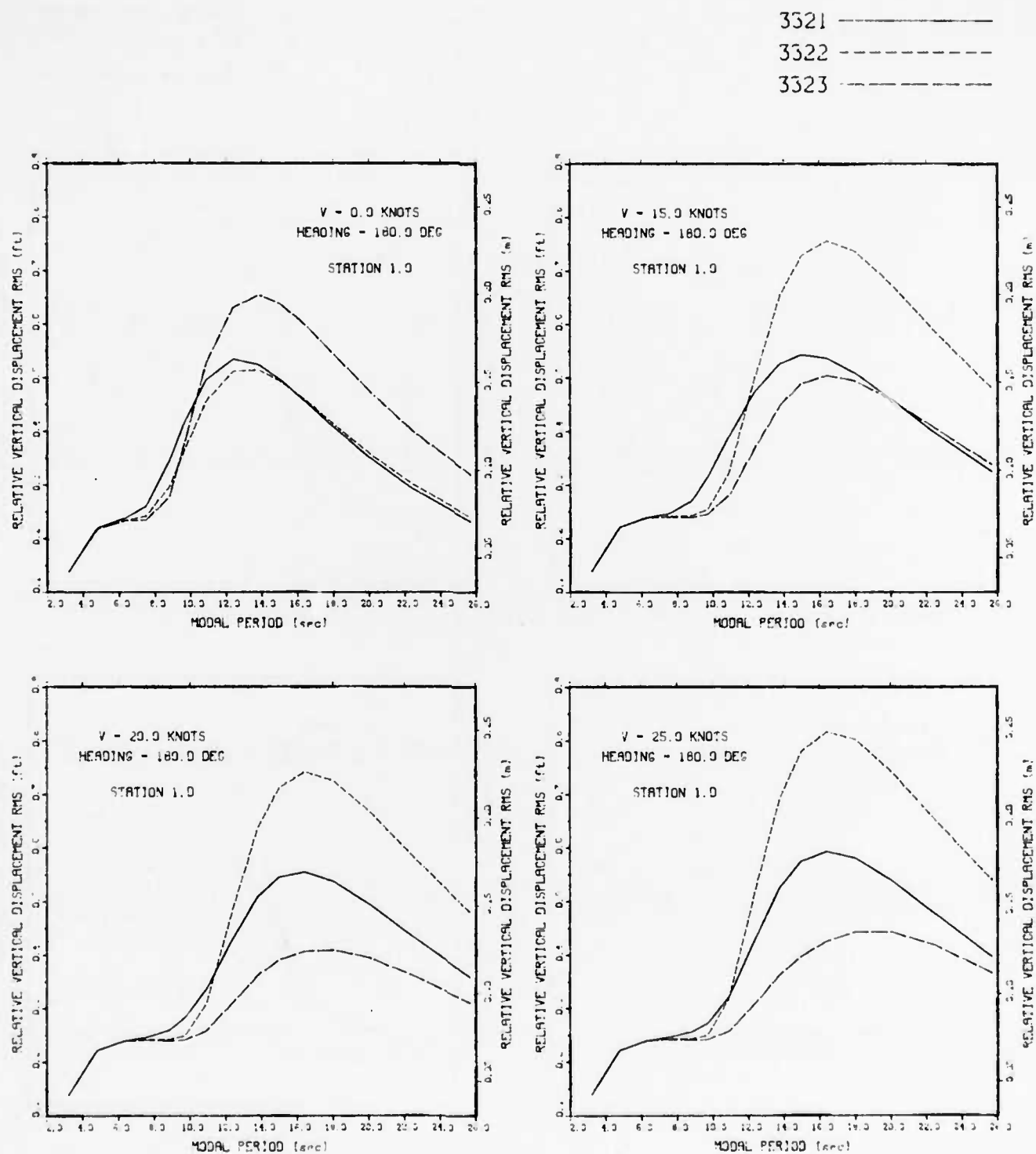


Figure 4z - Responses for Configurations 3321, 3322, and 3323

FIGURE 4 - CONTINUED

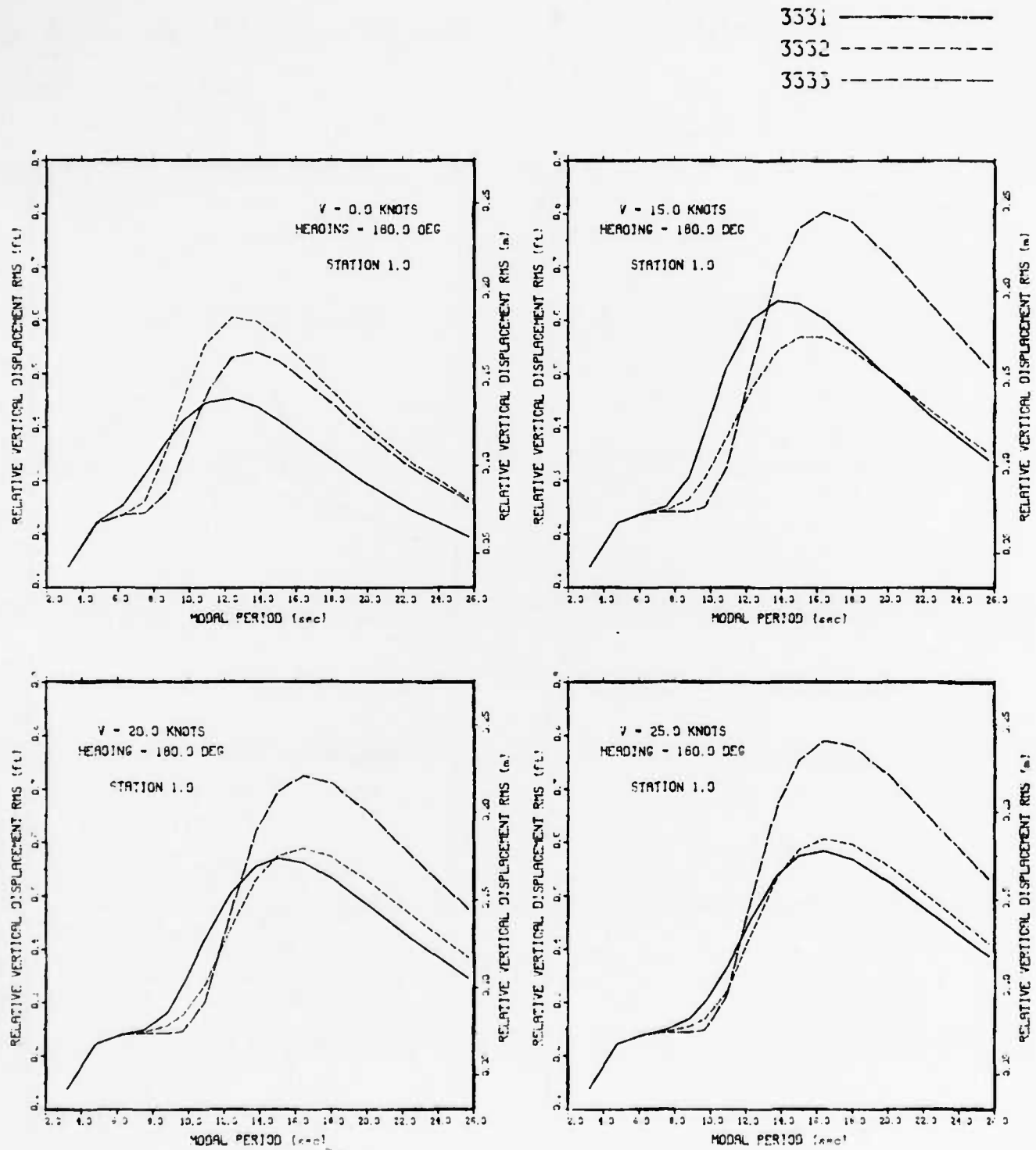


Figure 4aa - Responses for Configurations 3331, 3332, and 3333

FIGURE 5 - ABSOLUTE STERN MOTION RMS RESPONSES IN HEAD SEAS

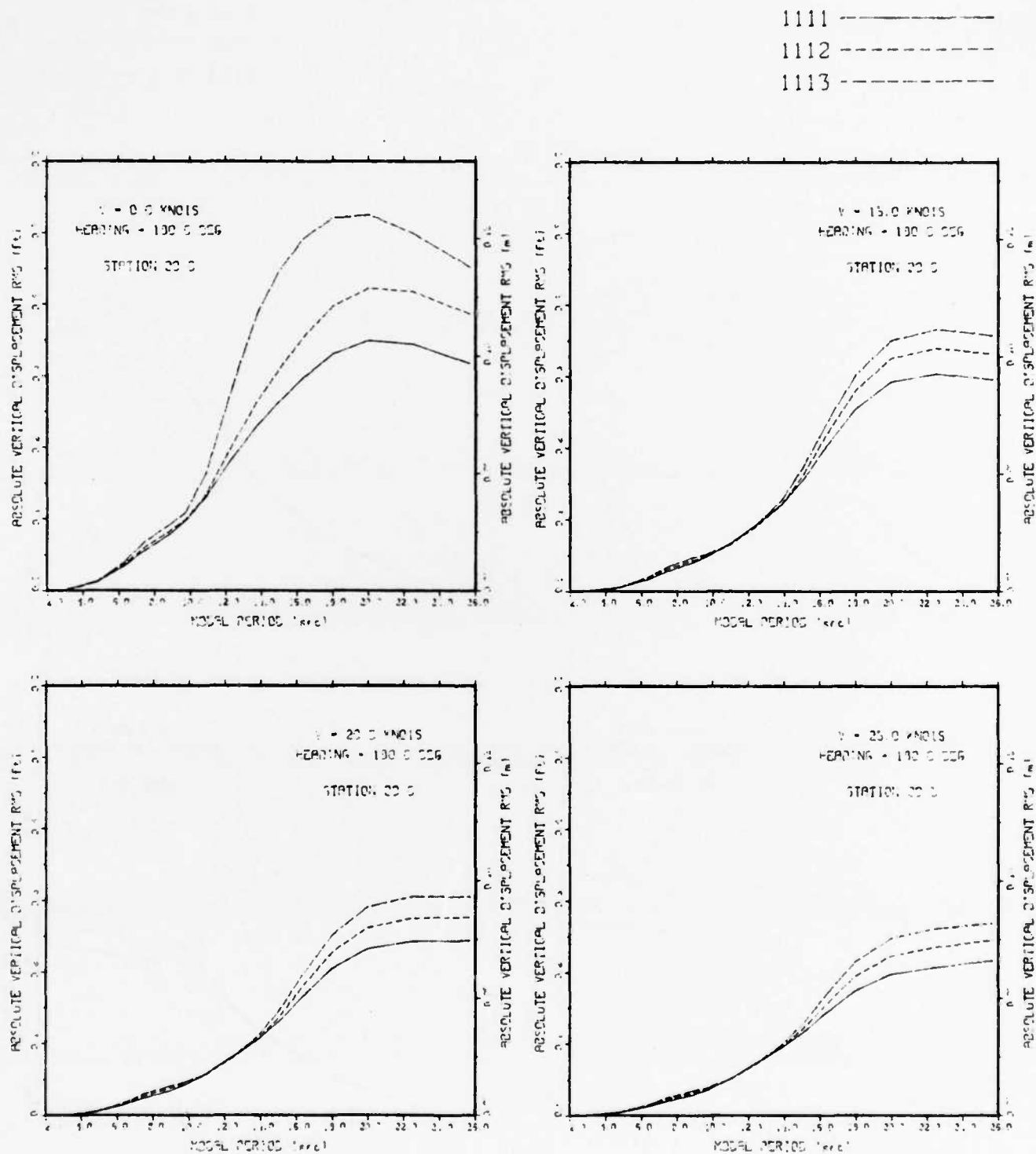


Figure 5a - Responses for Configurations 1111, 1112, and 1113

FIGURE 5 - CONTINUED

1121 —————
 1122 - - - - -
 1123 —————

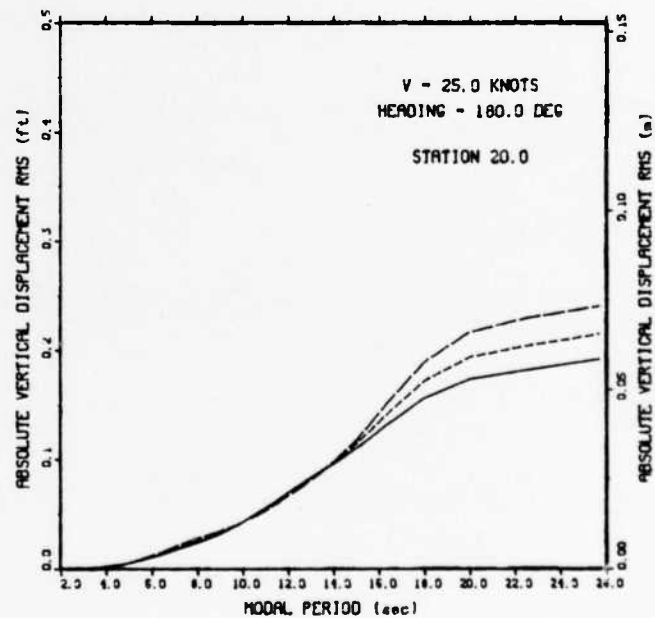
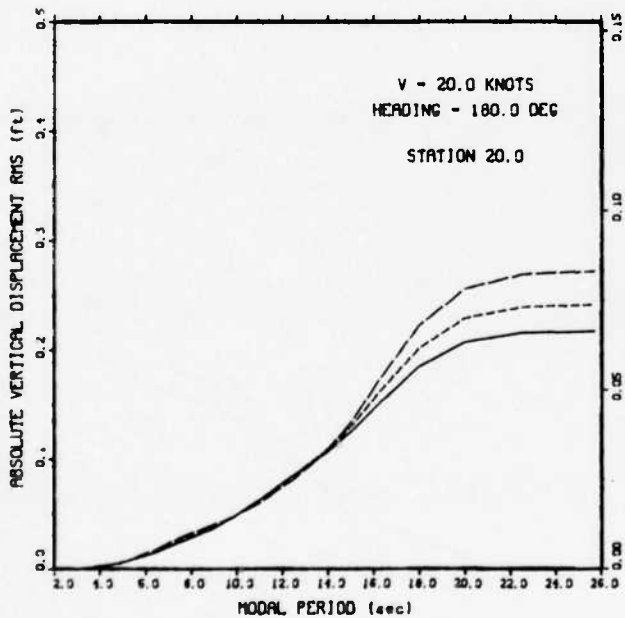
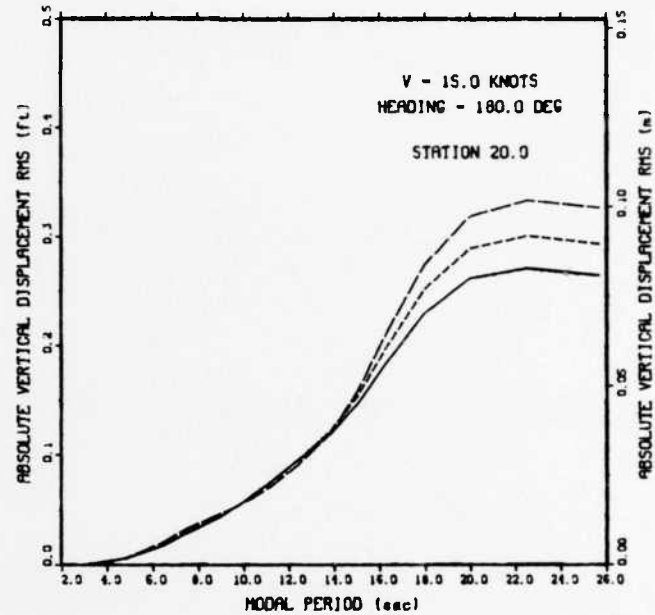
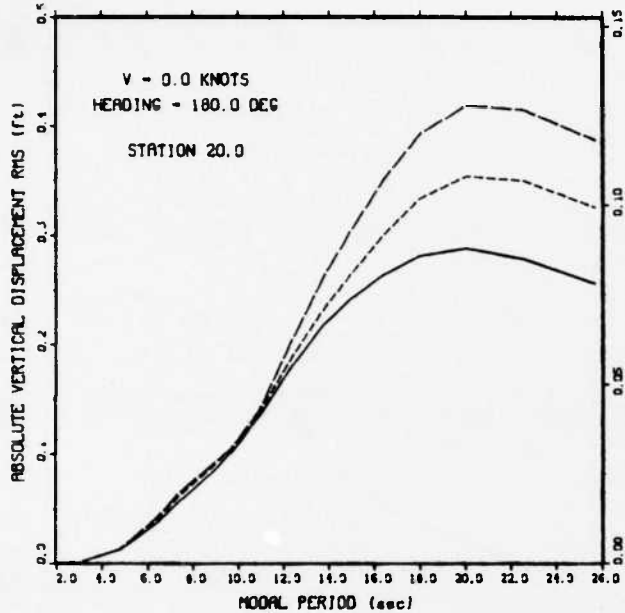


Figure 5b - Responses for Configurations 1121, 1122, and 1123

FIGURE 5 - CONTINUED

1131 —————
1132 - - - - -
1133 - - - - -

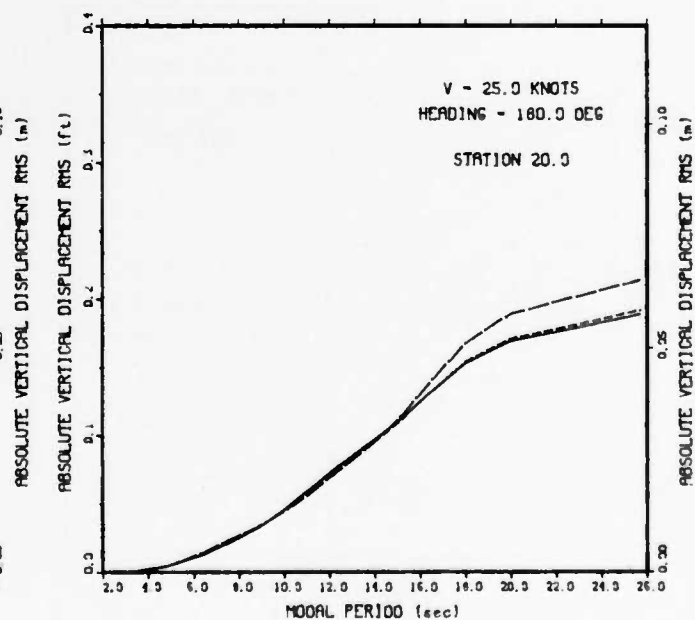
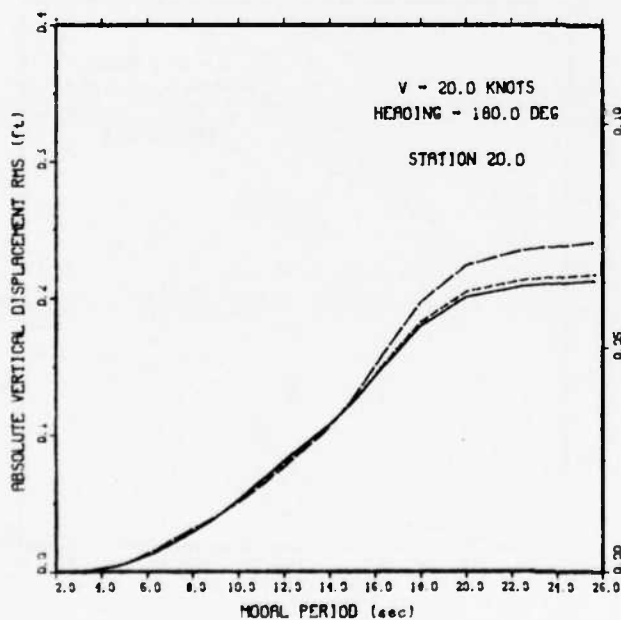
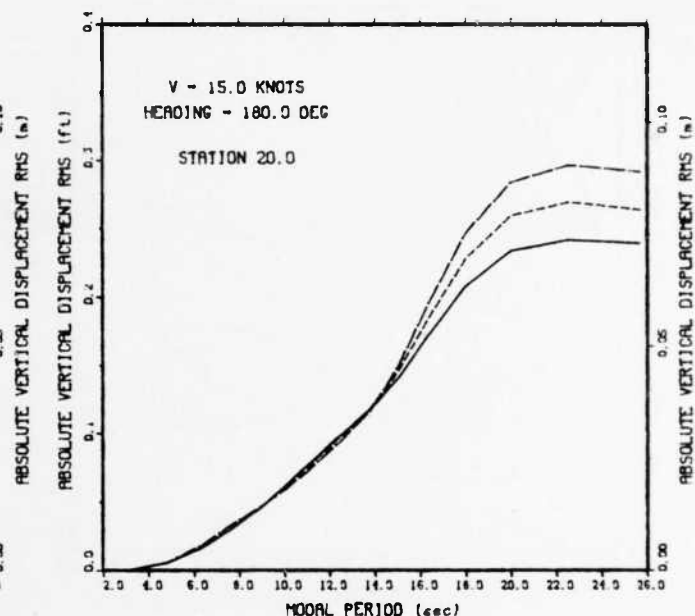
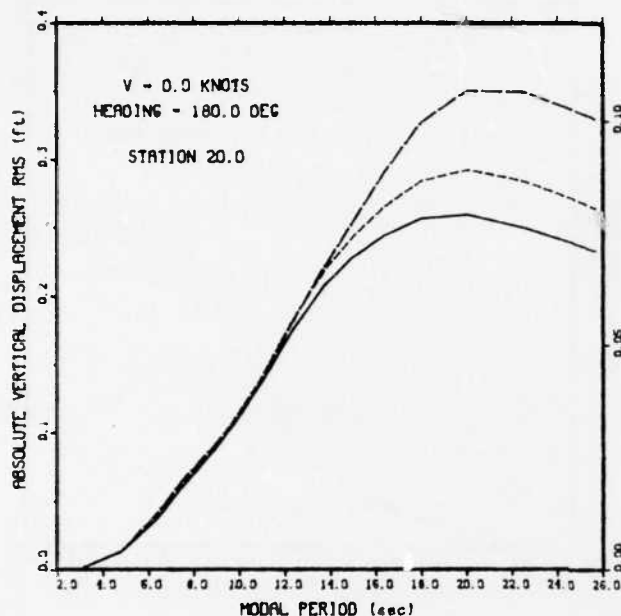


Figure 5c - Responses for Configurations 1131, 1132, and 1133

FIGURE 5 - CONTINUED

1211 —————
 1212 - - - - -
 1213 - - - - -

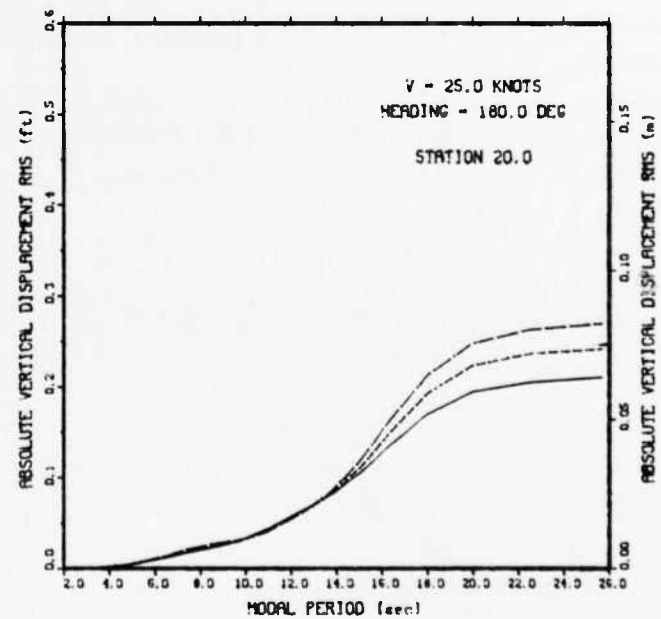
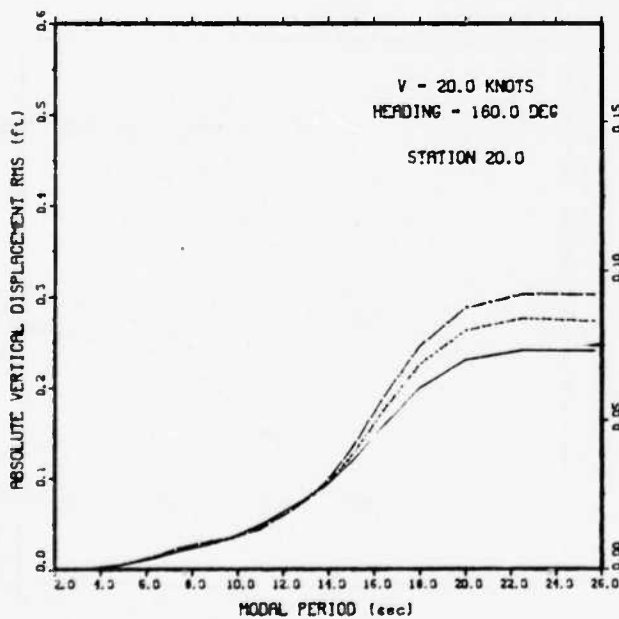
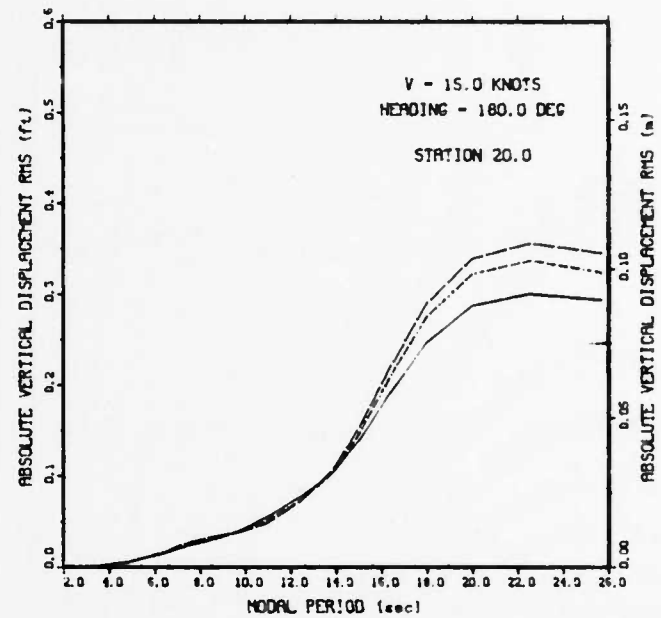
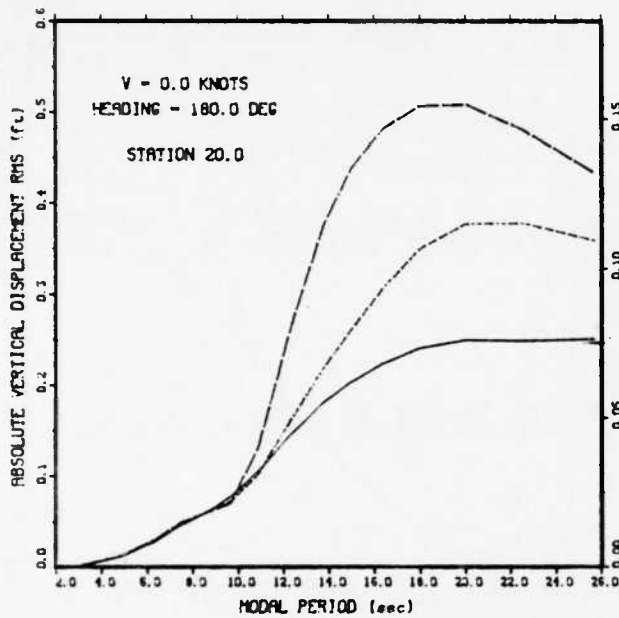


Figure 5d - Responses for Configurations 1211, 1212, and 1213

FIGURE 5 - CONTINUED

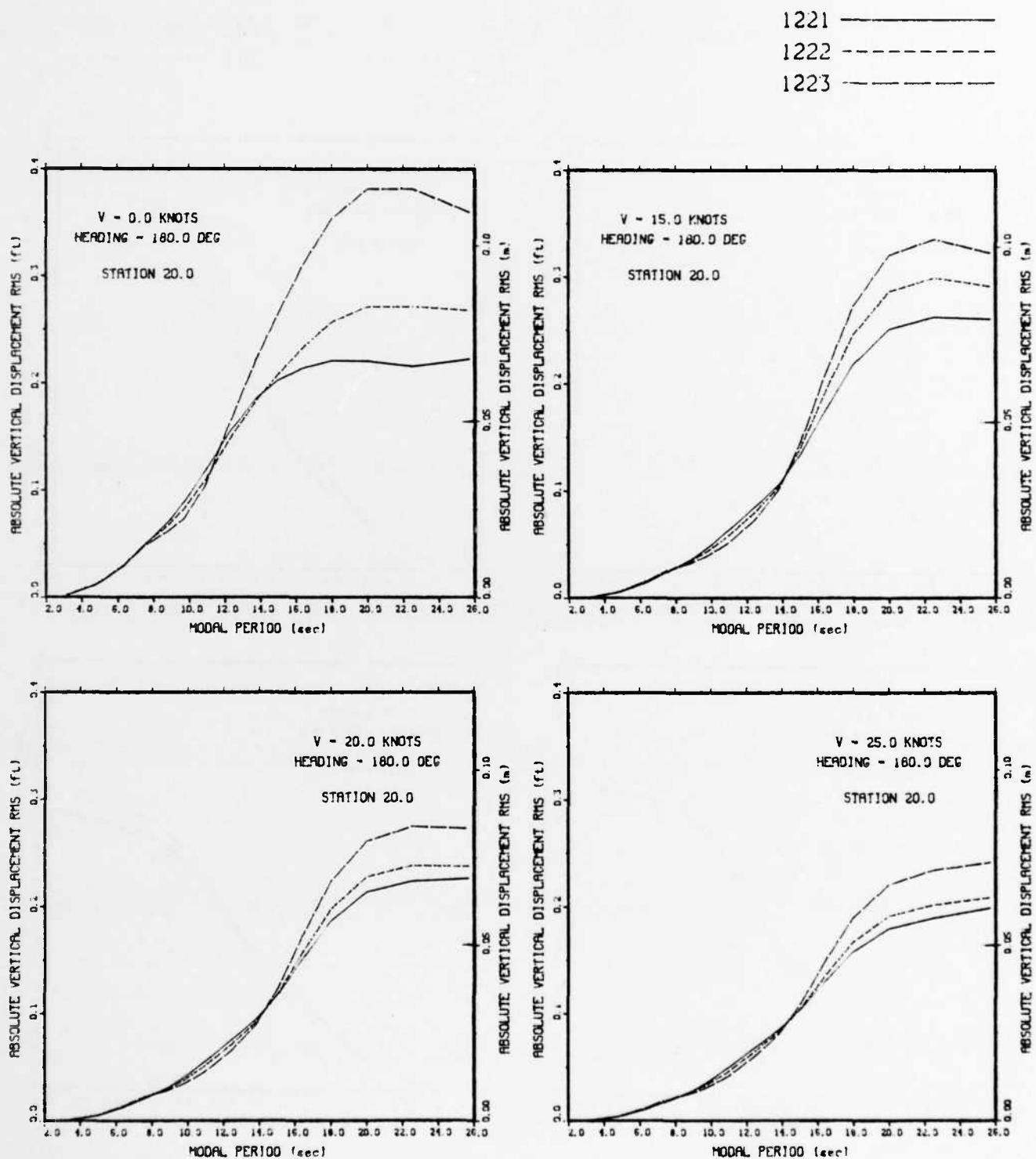


Figure 5e - Responses for Configurations 1221, 1222, and 1223

FIGURE 5 - CONTINUED

1231 —————
 1232 - - - - -
 1233 - - - - -

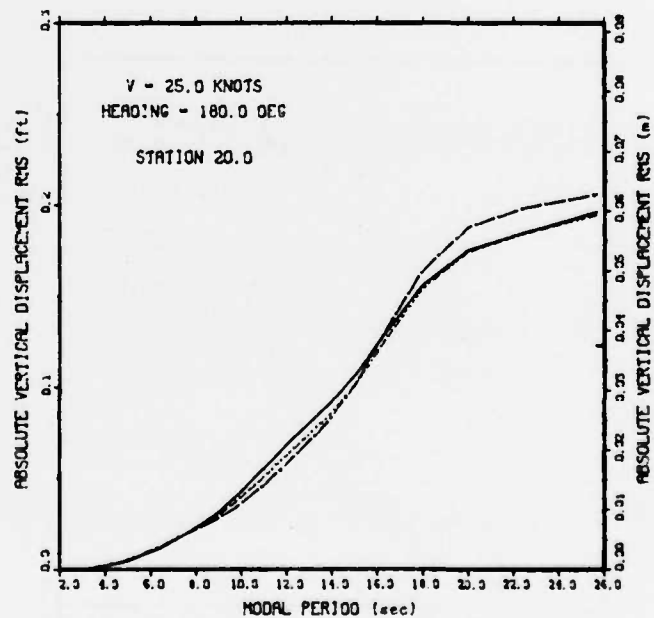
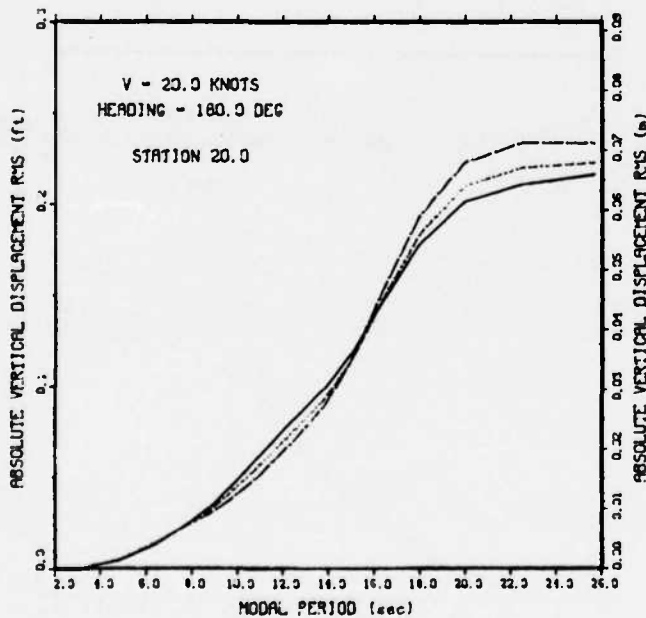
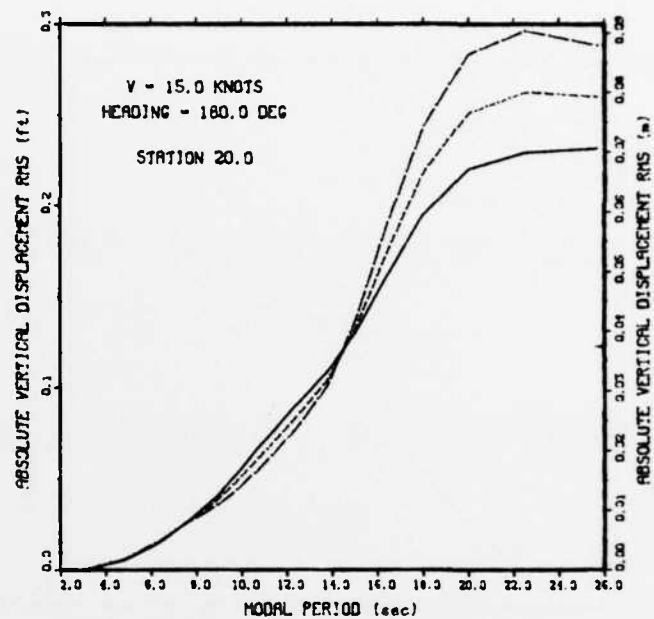
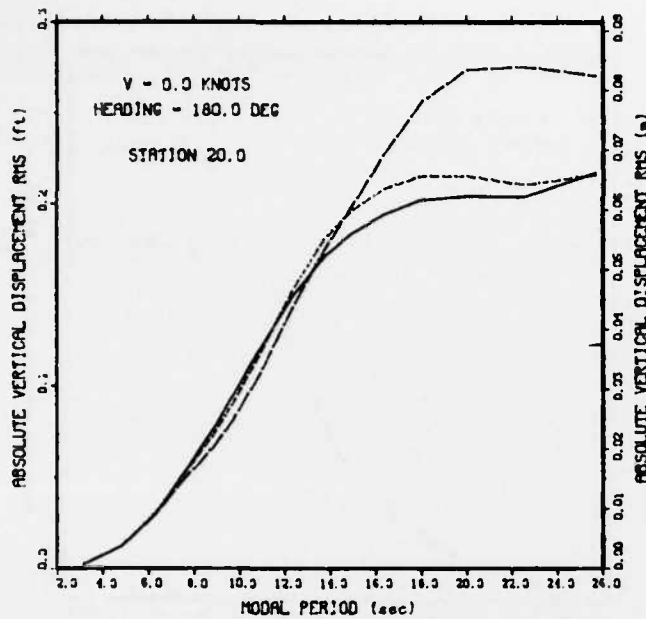


Figure 5f - Responses for Configurations 1231, 1232, and 1233

FIGURE 5 - CONTINUED

1311 —————
 1312 - - - - -
 1313 — · — · —

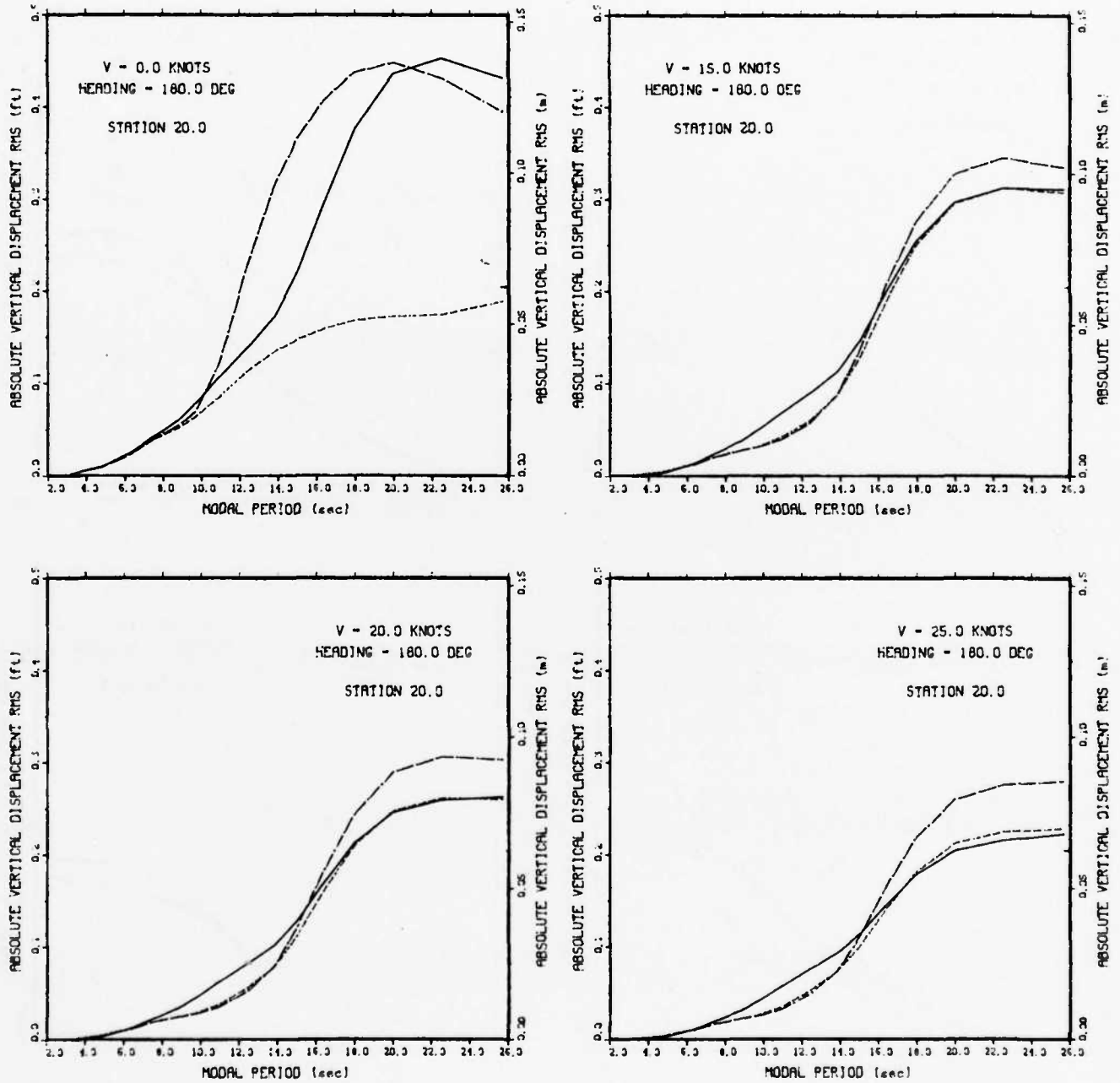


Figure 5g - Responses for Configurations 1311, 1312, and 1313

FIGURE 5 - CONTINUED

1321 —————
 1322 - - - - -
 1323 -

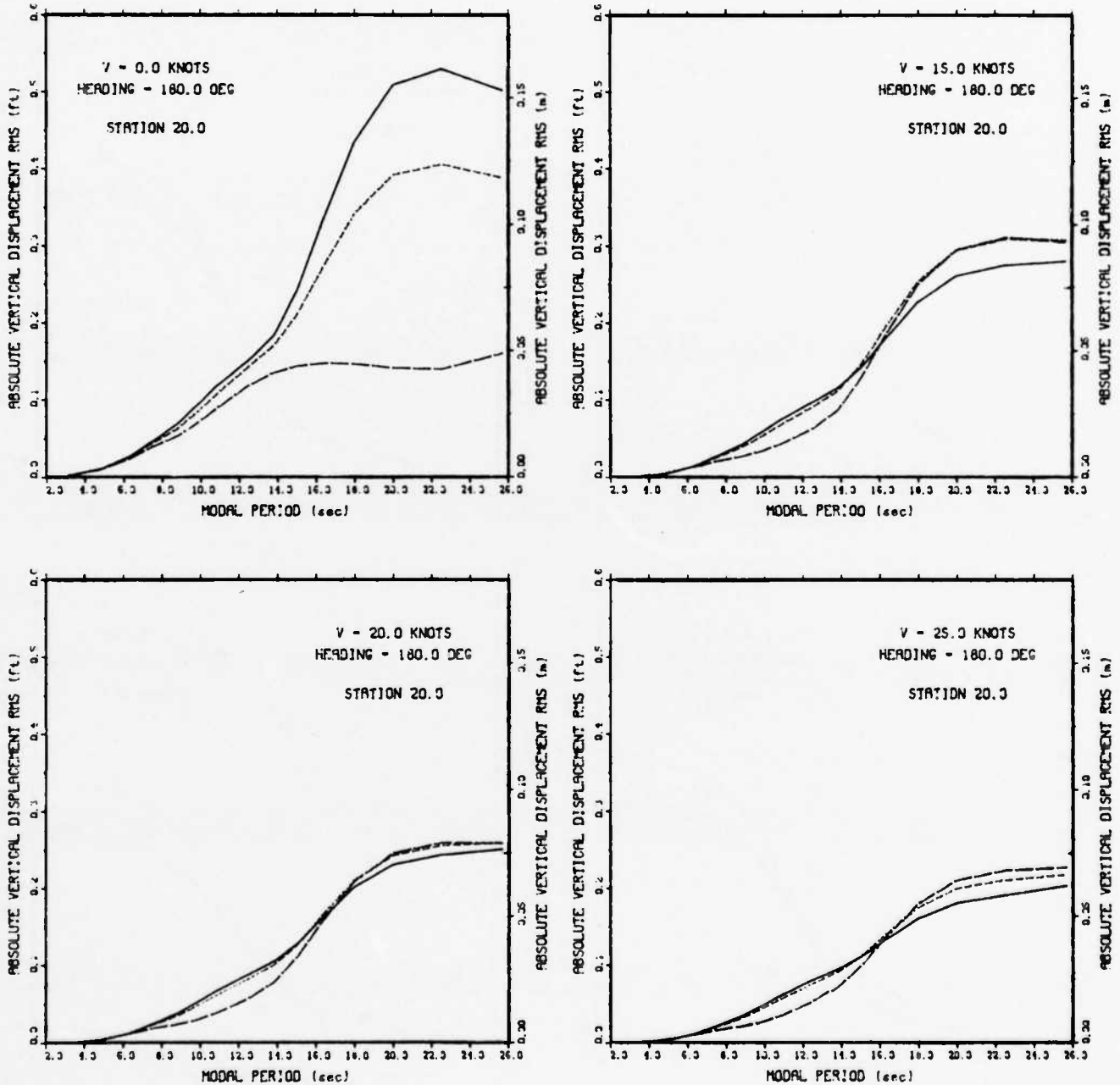


Figure 5h - Responses for Configurations 1321, 1322, and 1323

FIGURE 5 - CONTINUED

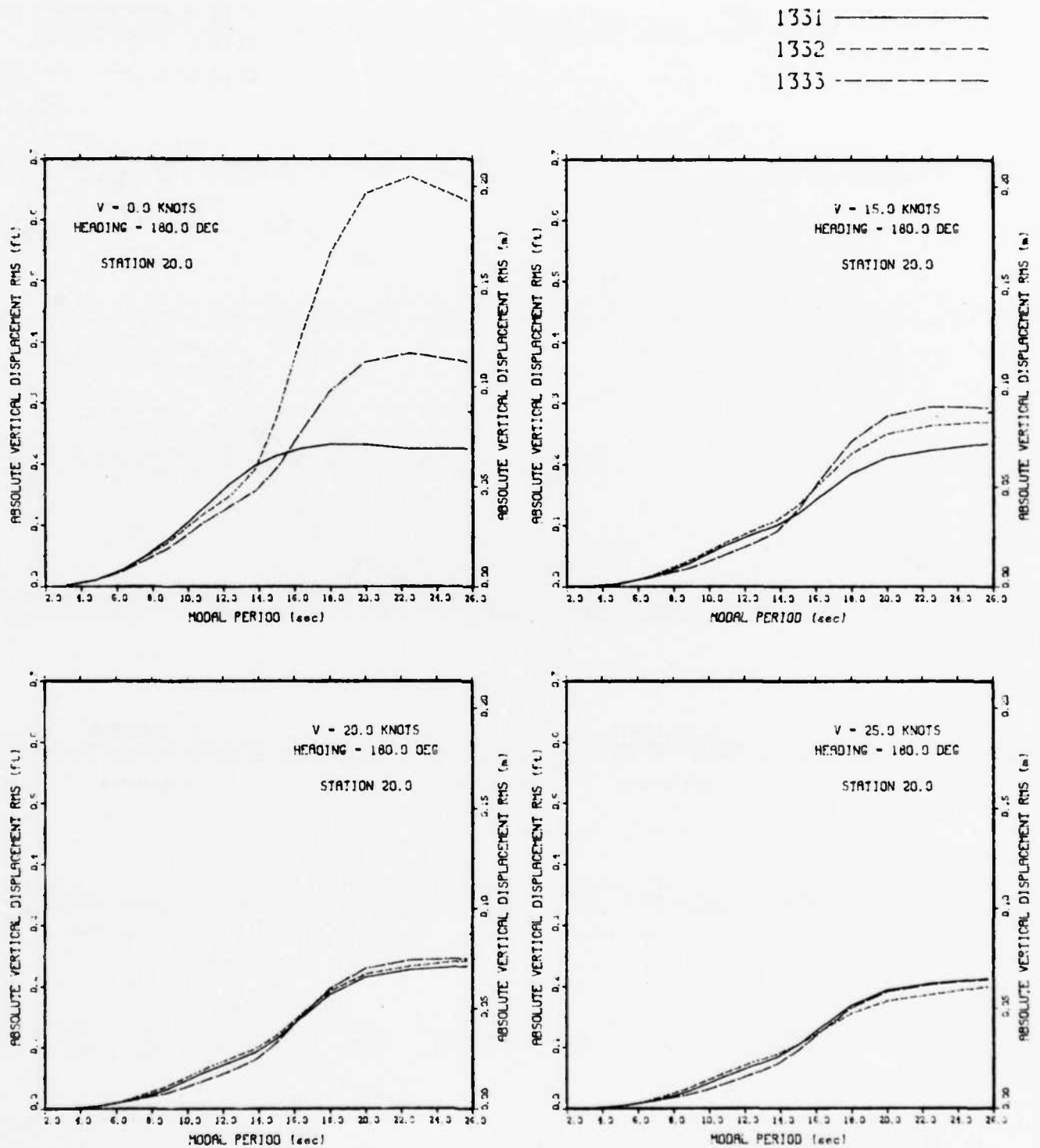


Figure 51 - Responses for Configurations 1331, 1332, and 1333

FIGURE 5 - CONTINUED

2111 —————
 2112 - - - - -
 2113 - - - - -

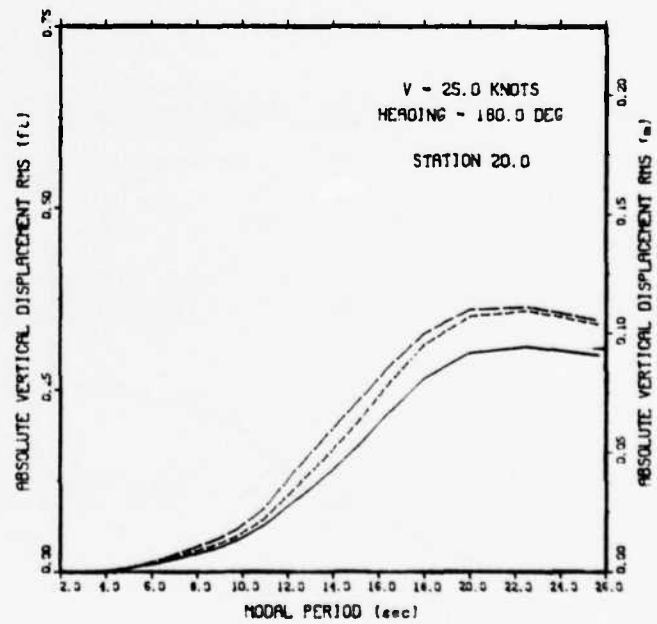
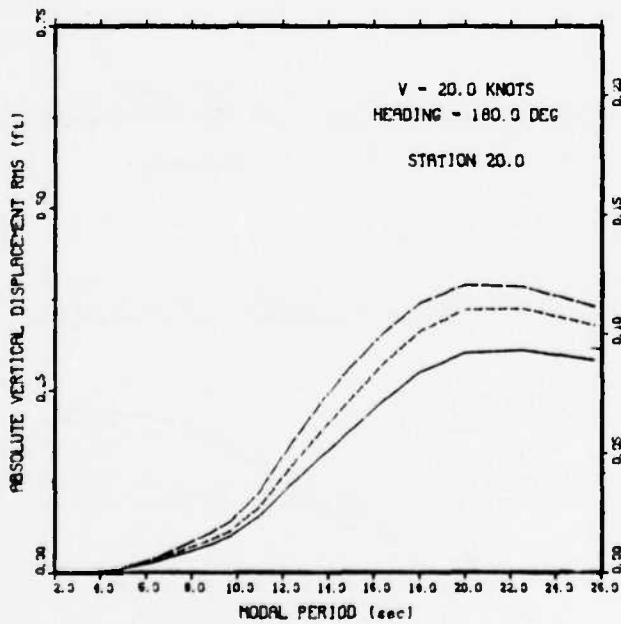
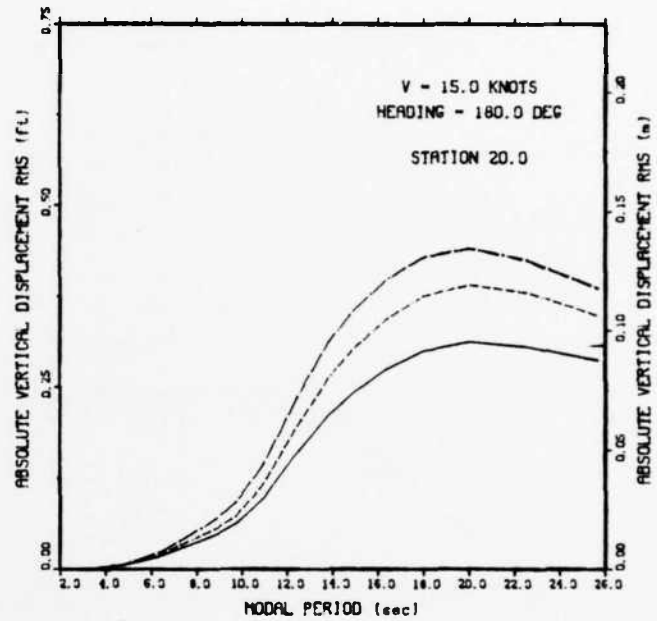
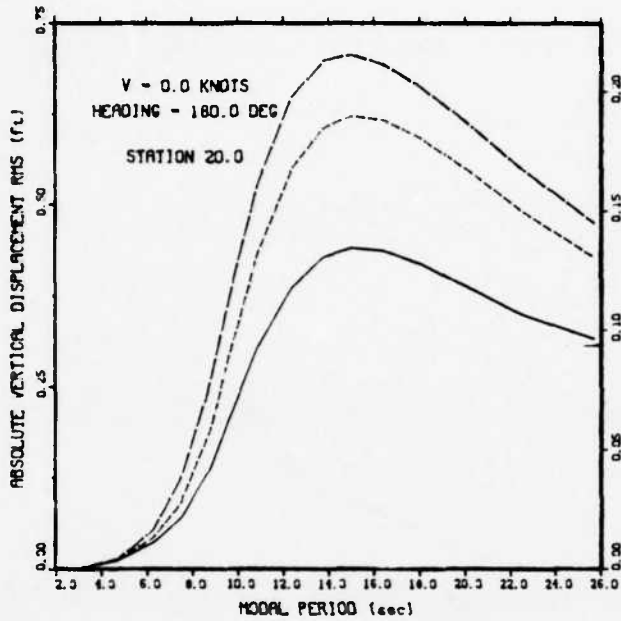


Figure 5j - Responses for Configurations 2111, 2112, and 2113

FIGURE 5 - CONTINUED

2121 —————
 2122 - - - - -
 2123 ————

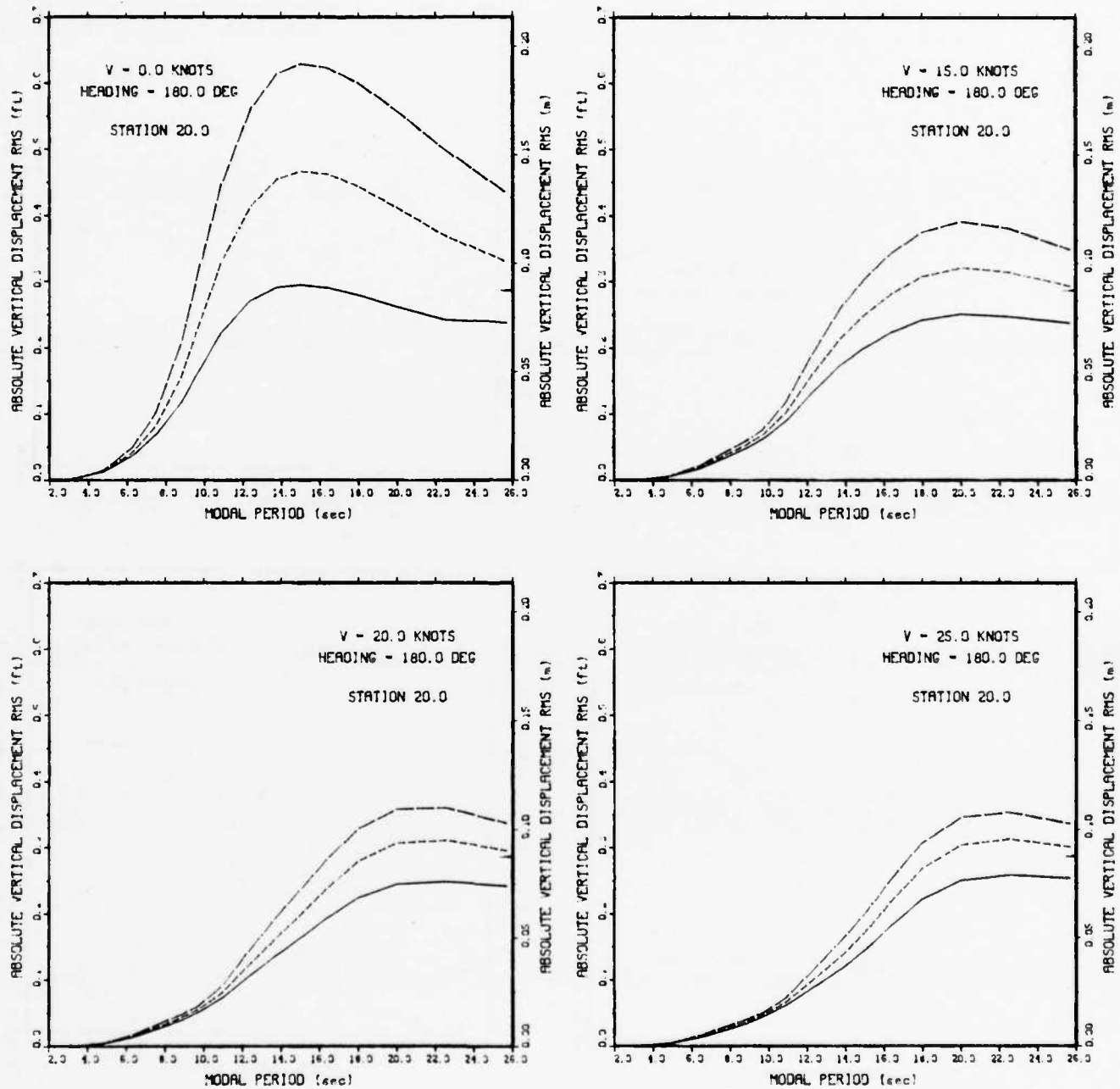


Figure 5k - Responses for Configurations 2121, 2122, and 2123

FIGURE 5 - CONTINUED

2132 - - - - -
2133 - - - - -

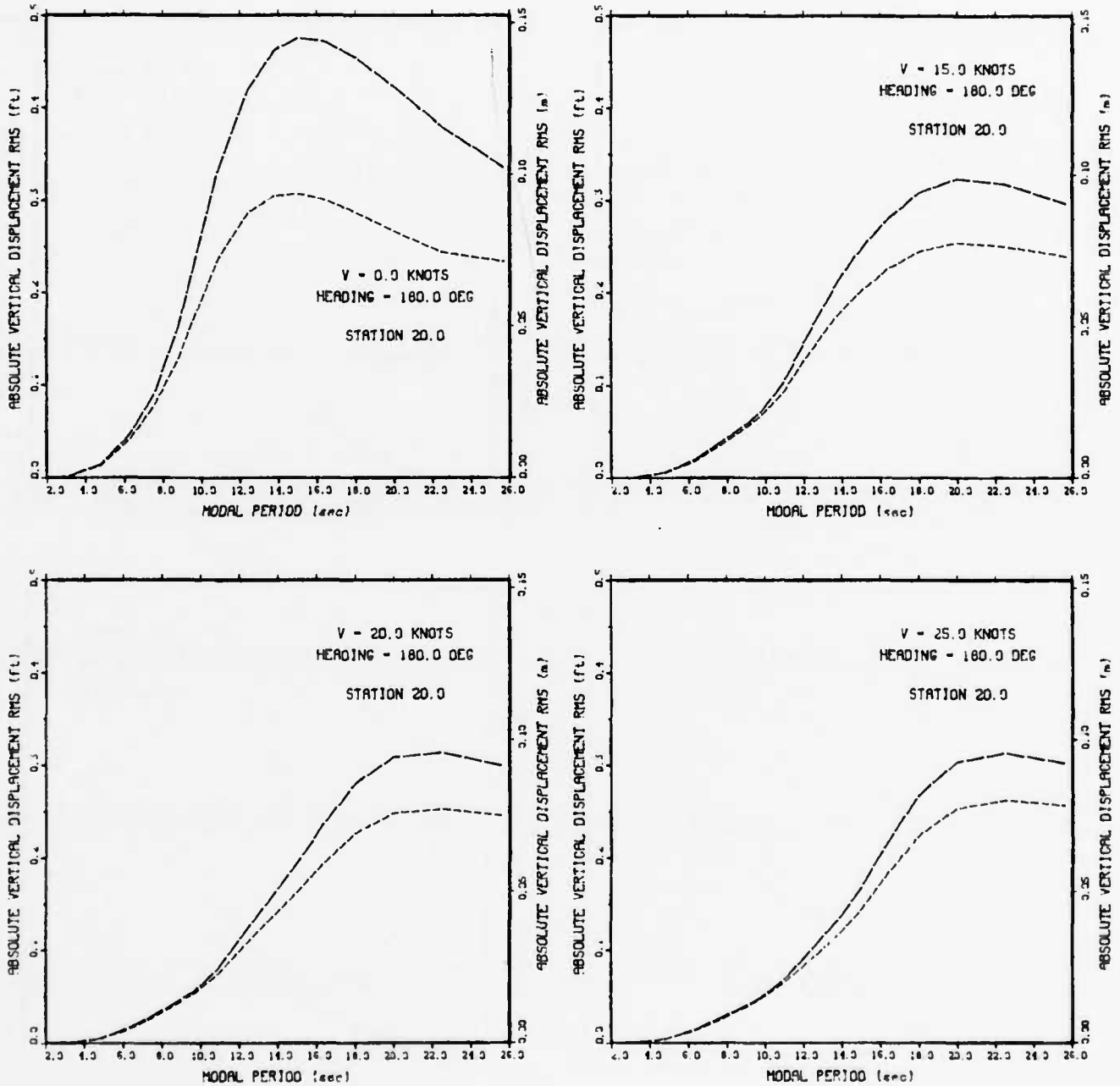


Figure 51 - Responses for Configurations 2132 and 2133

FIGURE 5 - CONTINUED

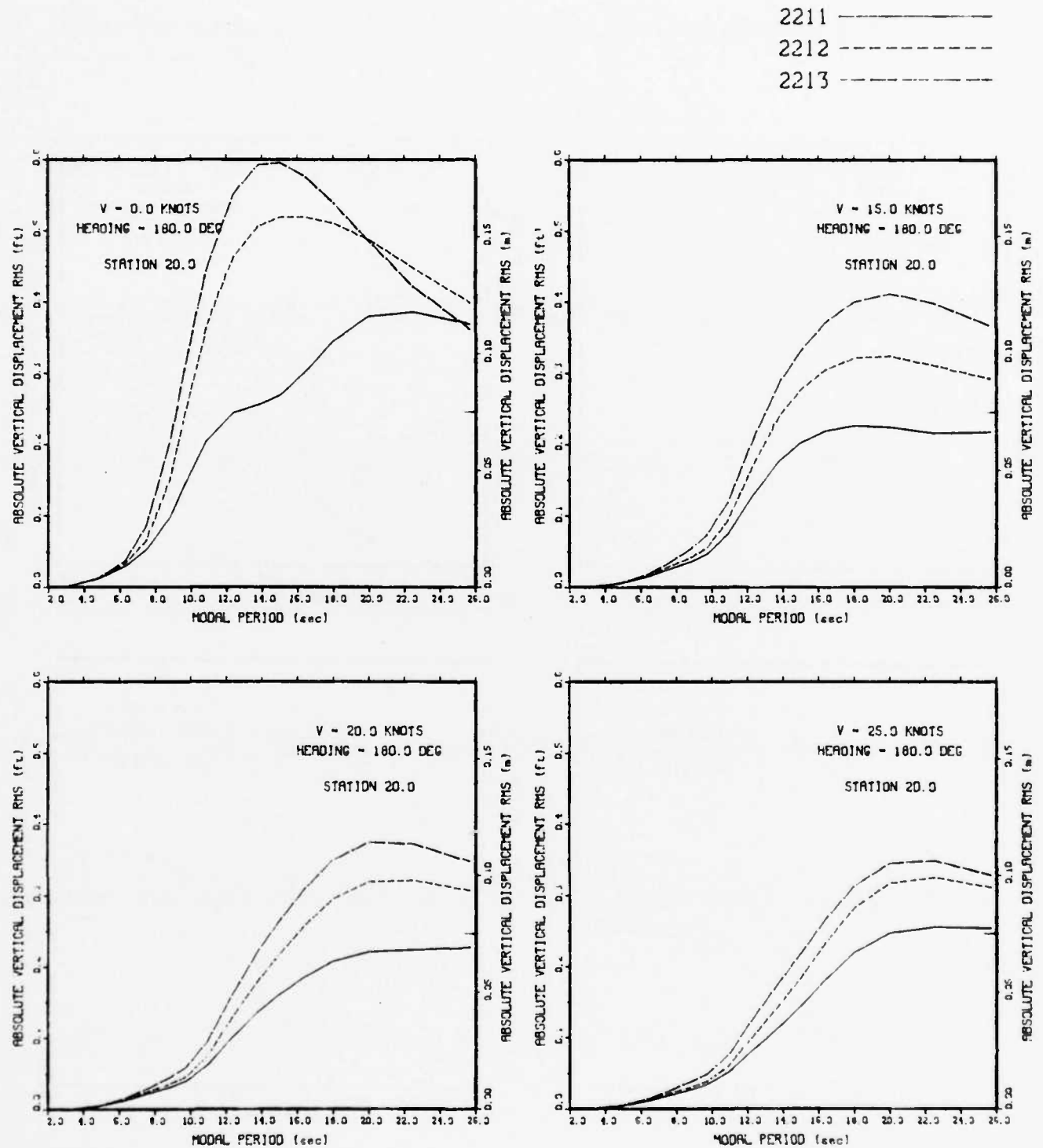


Figure 5m - Responses for Configurations 2211, 2212, and 2213

FIGURE 5 - CONTINUED

2221 —————
 2222 - - - - -
 2223 —————

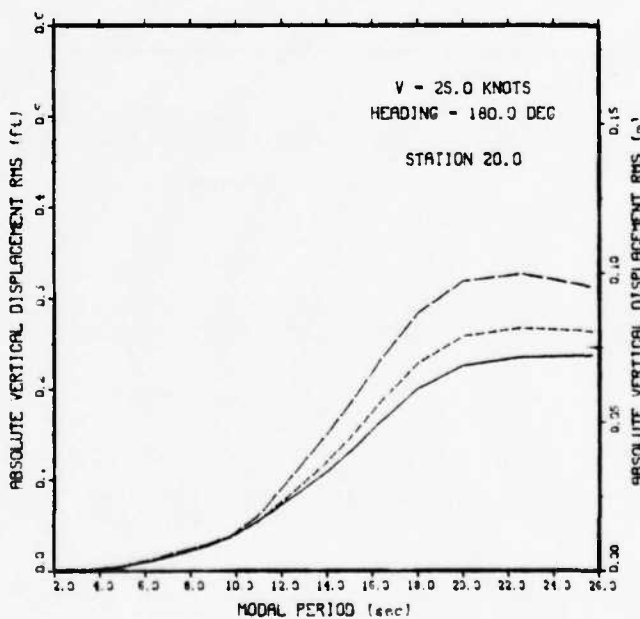
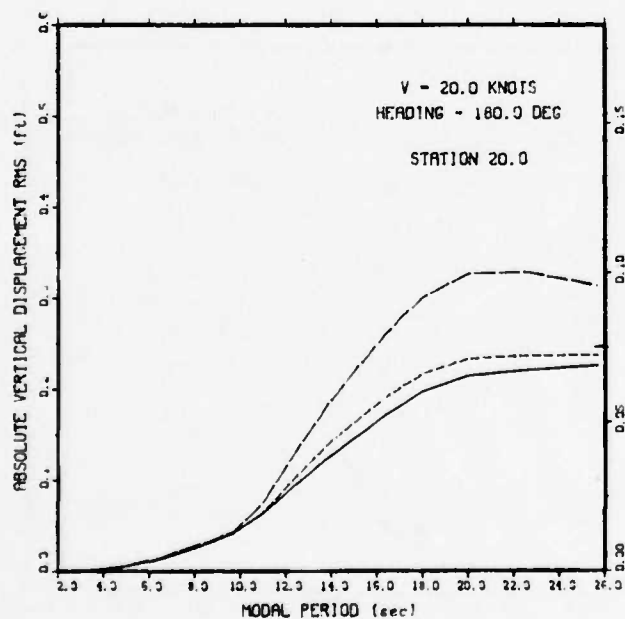
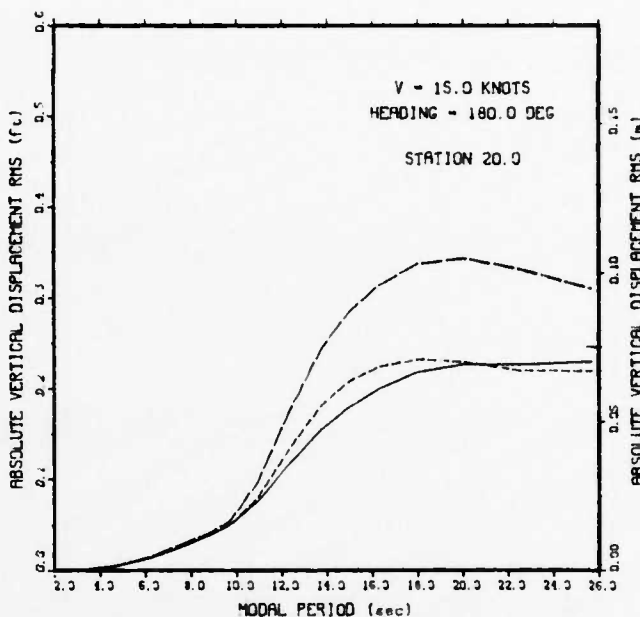
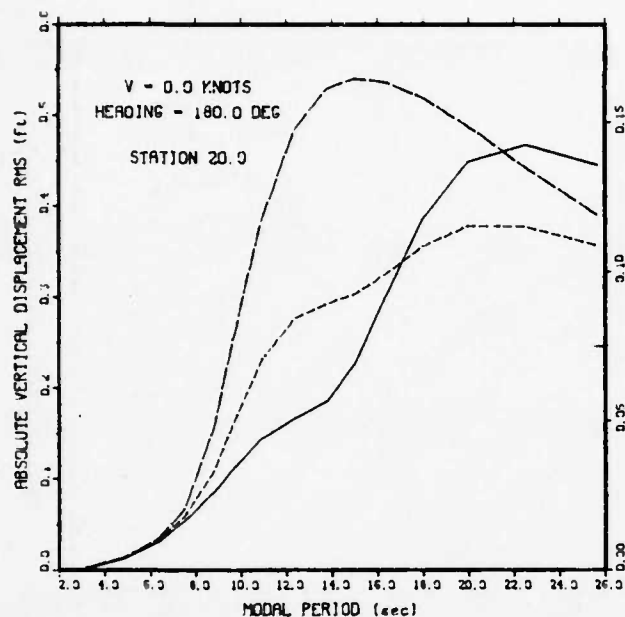


Figure 5n - Responses for Configurations 2221, 2222, and 2223

FIGURE 5 - CONTINUED

2231 —————
 2232 - - - - -
 2233 - - - - -

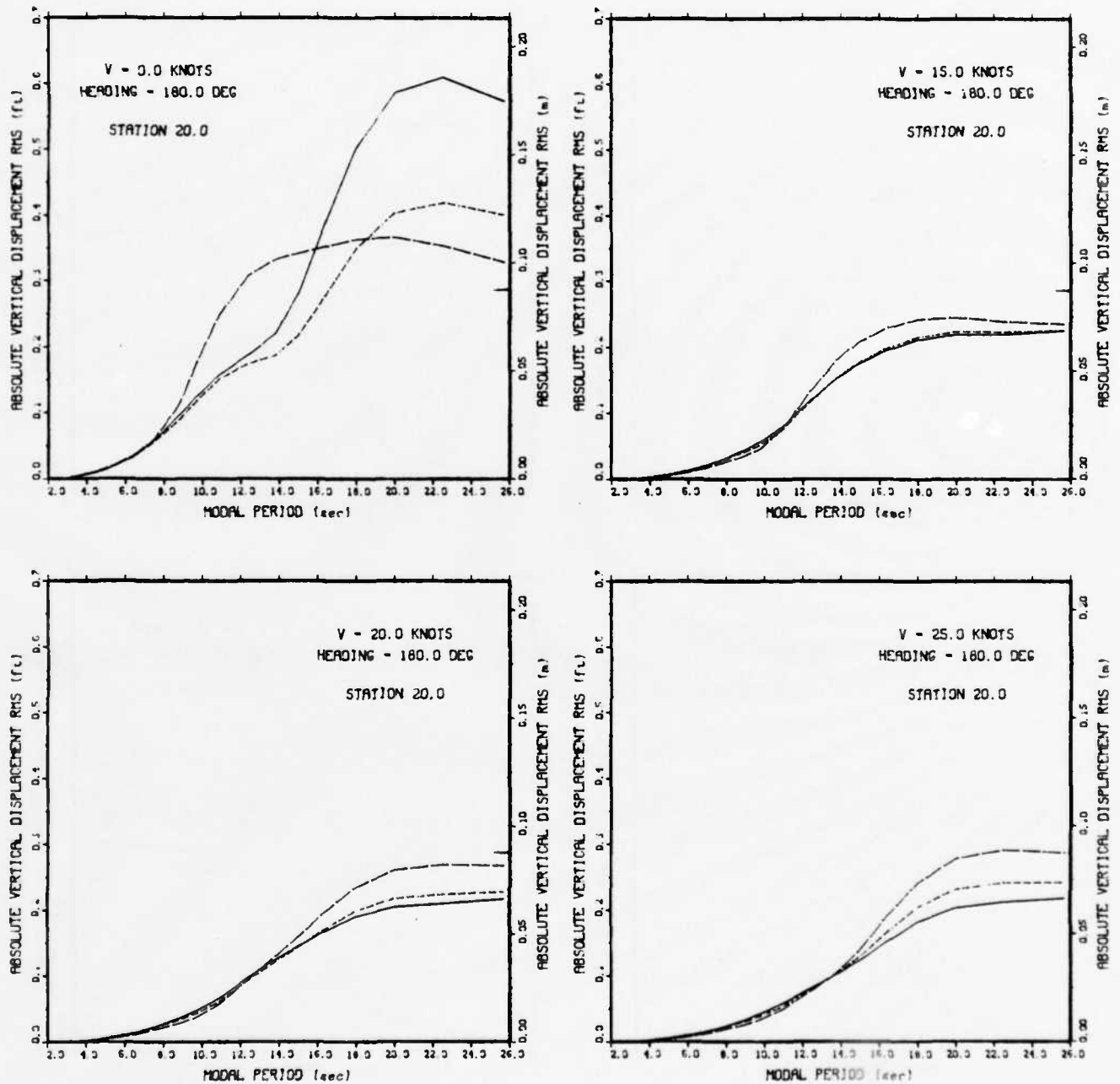


Figure 5a - Responses for Configurations 2231, 2232, and 2233

FIGURE 5 - CONTINUED

2311 —————
 2312 - - - - -
 2313 - - - - -

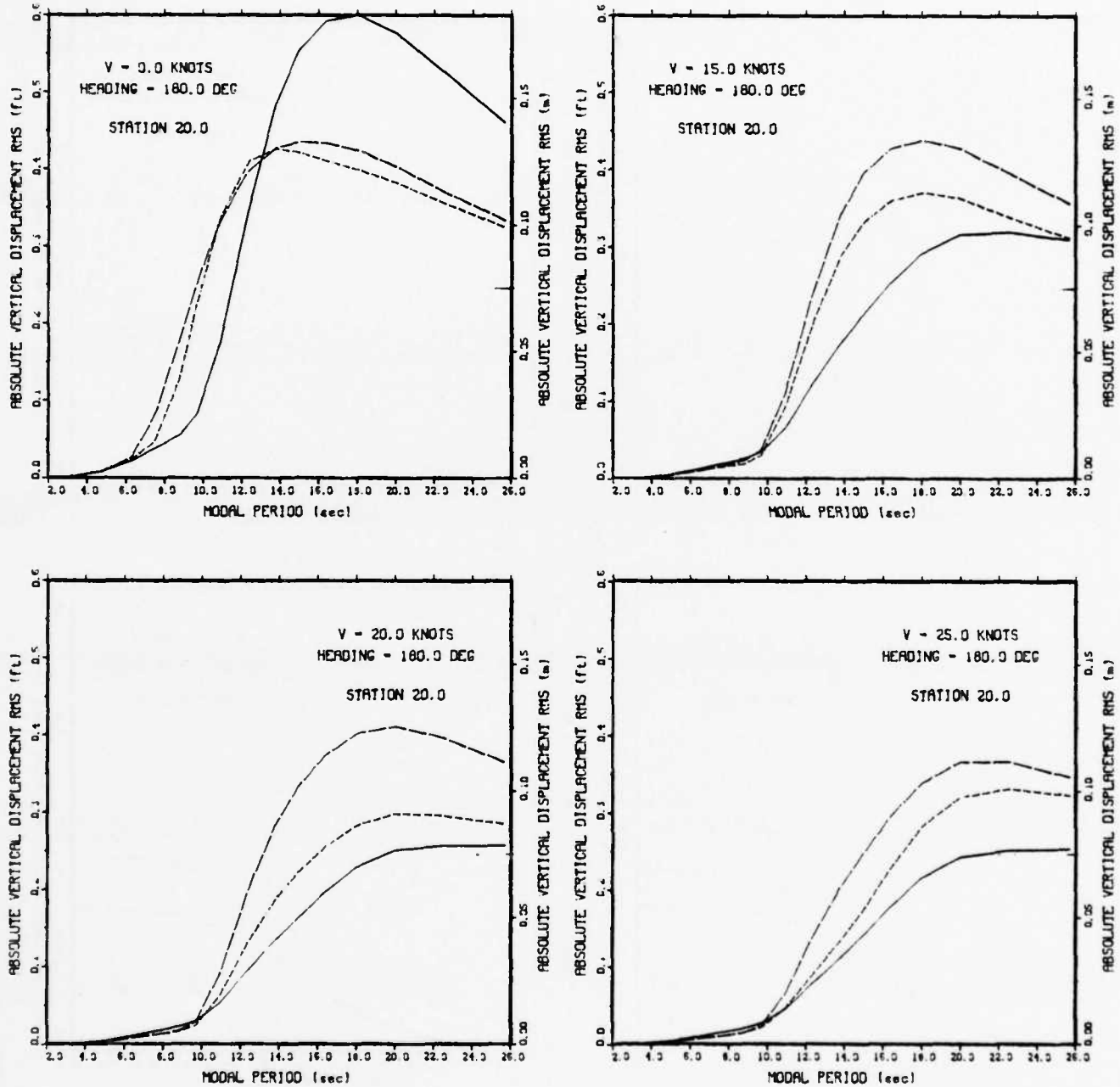


Figure 5p - Responses for Configurations 2311, 2312, and 2313

FIGURE 5 - CONTINUED

2321 —————
 2322 - - - - -
 2323 ————

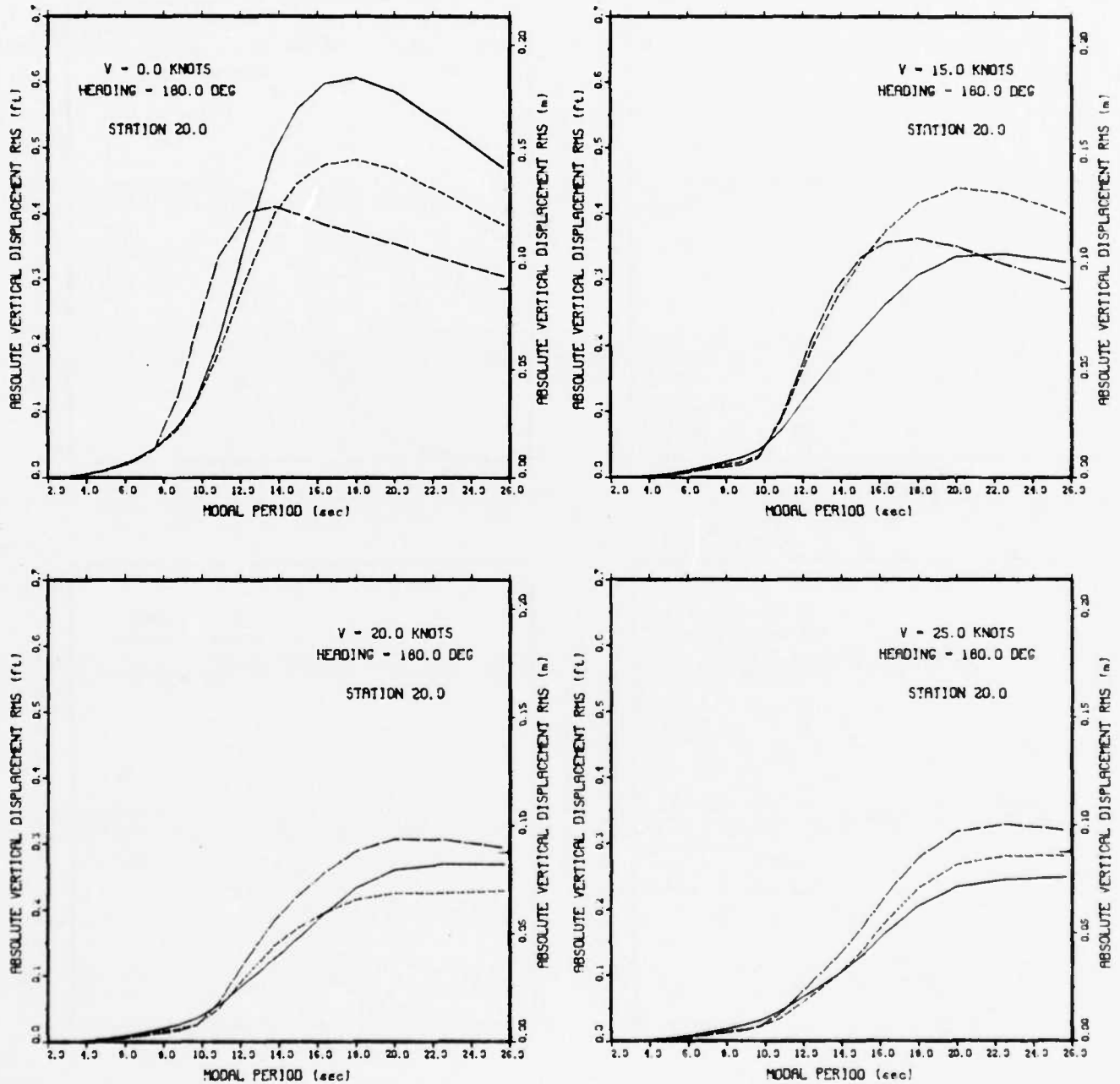


Figure 5q - Responses for Configurations 2321, 2322, and 2323

FIGURE 5 - CONTINUED

2331 ———
2332 - - -
2333 - - -

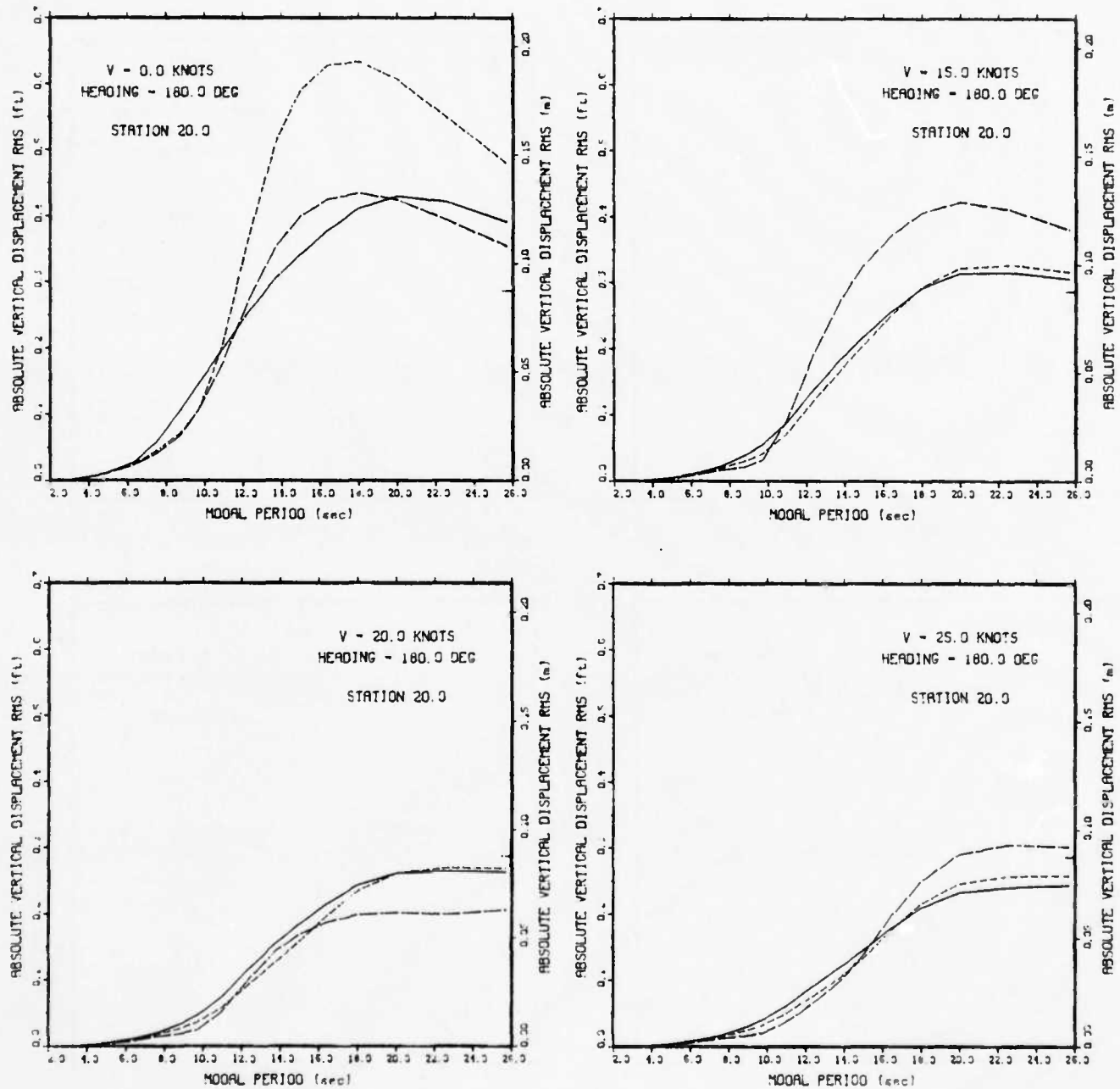


Figure 5r - Responses for Configurations 2331, 2332, and 2333

FIGURE 5 - CONTINUED

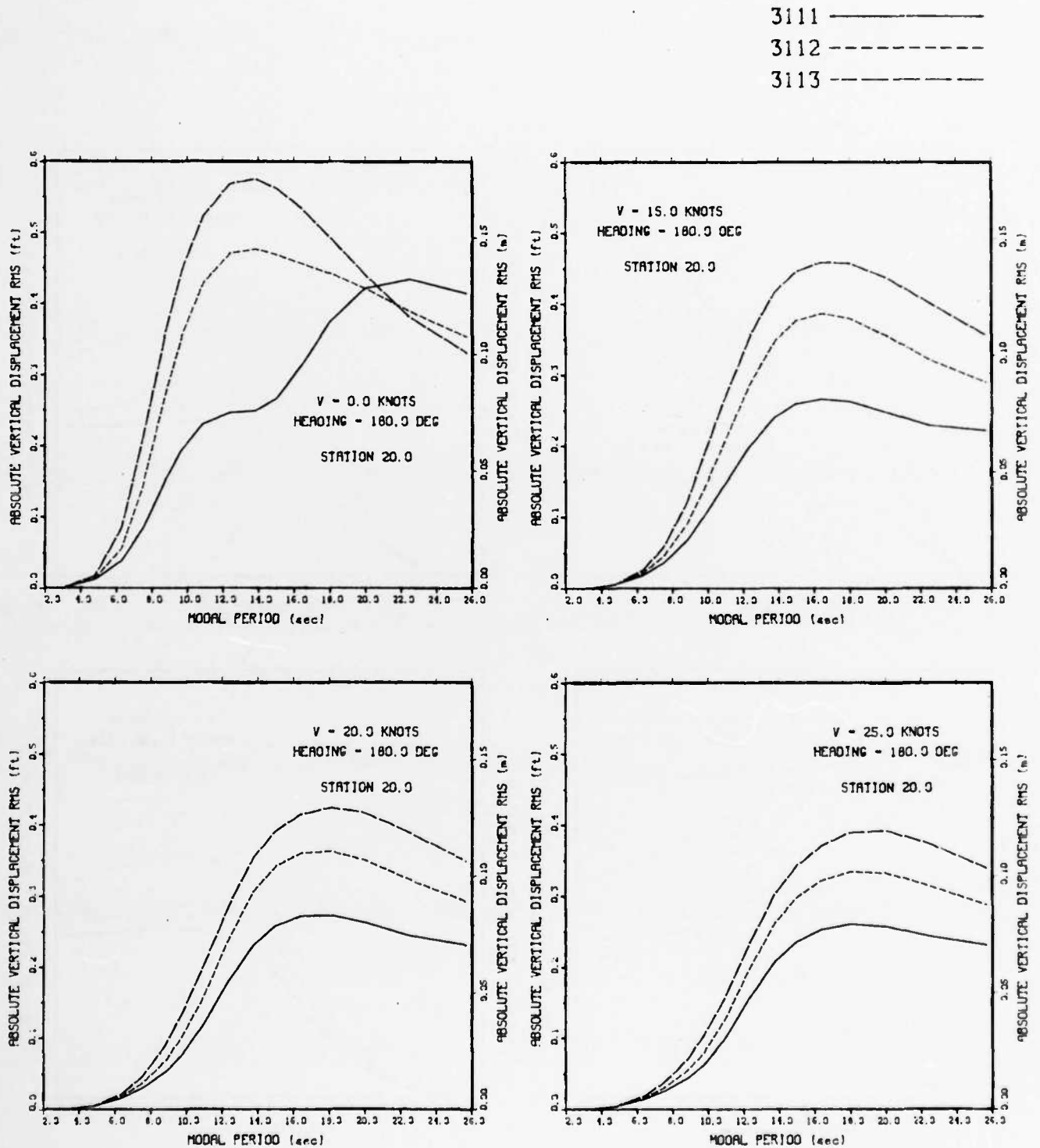


Figure 5s - Responses for Configurations 3111, 3112, and 3113

FIGURE 5 - CONTINUED

3121 —————
 3122 - - - - -
 3123 -

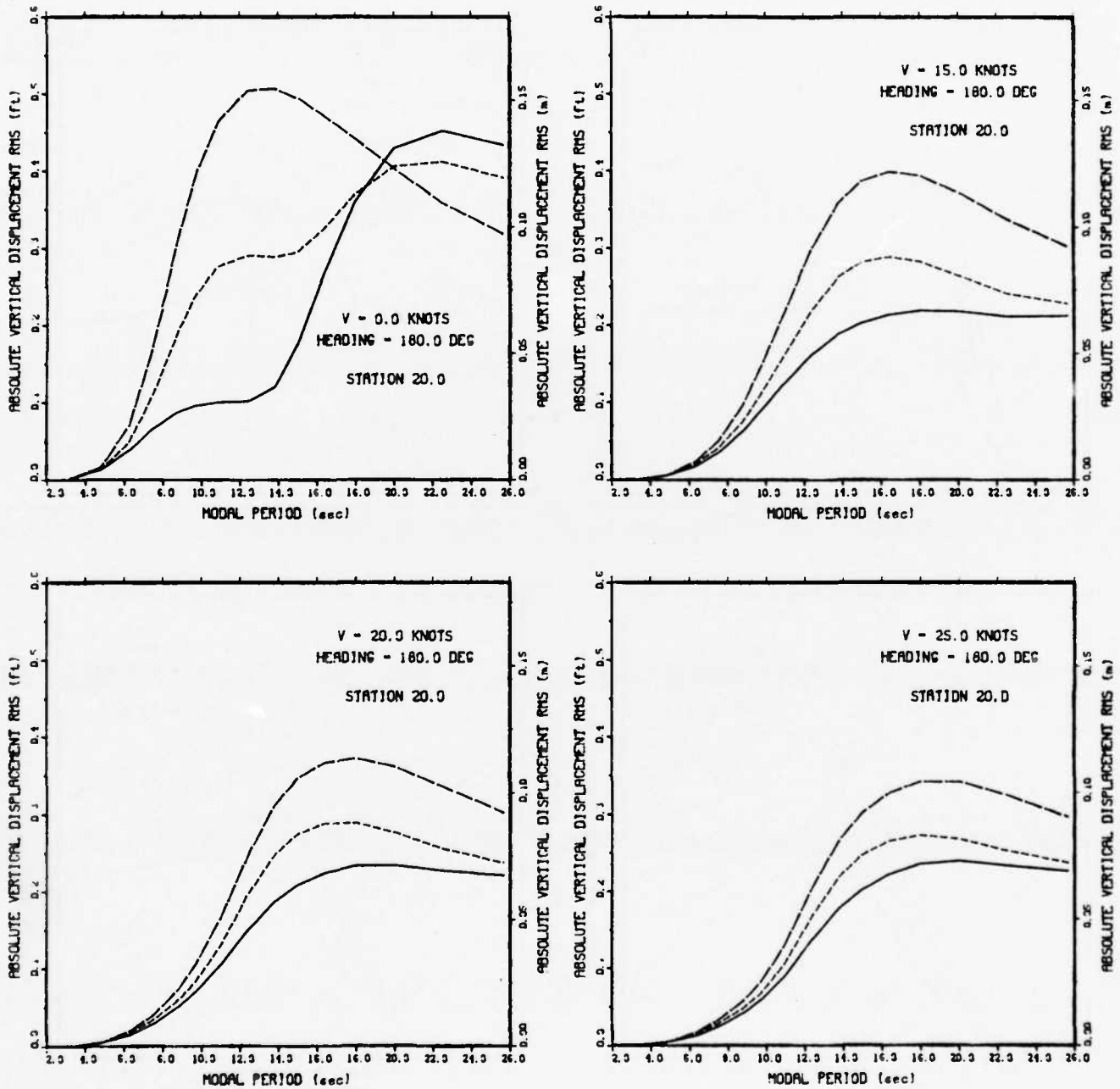


Figure 5t - Responses for Configurations 3121, 3122, and 3123

FIGURE 5 - CONTINUED

3132 - - - - -
3133 - - - - -

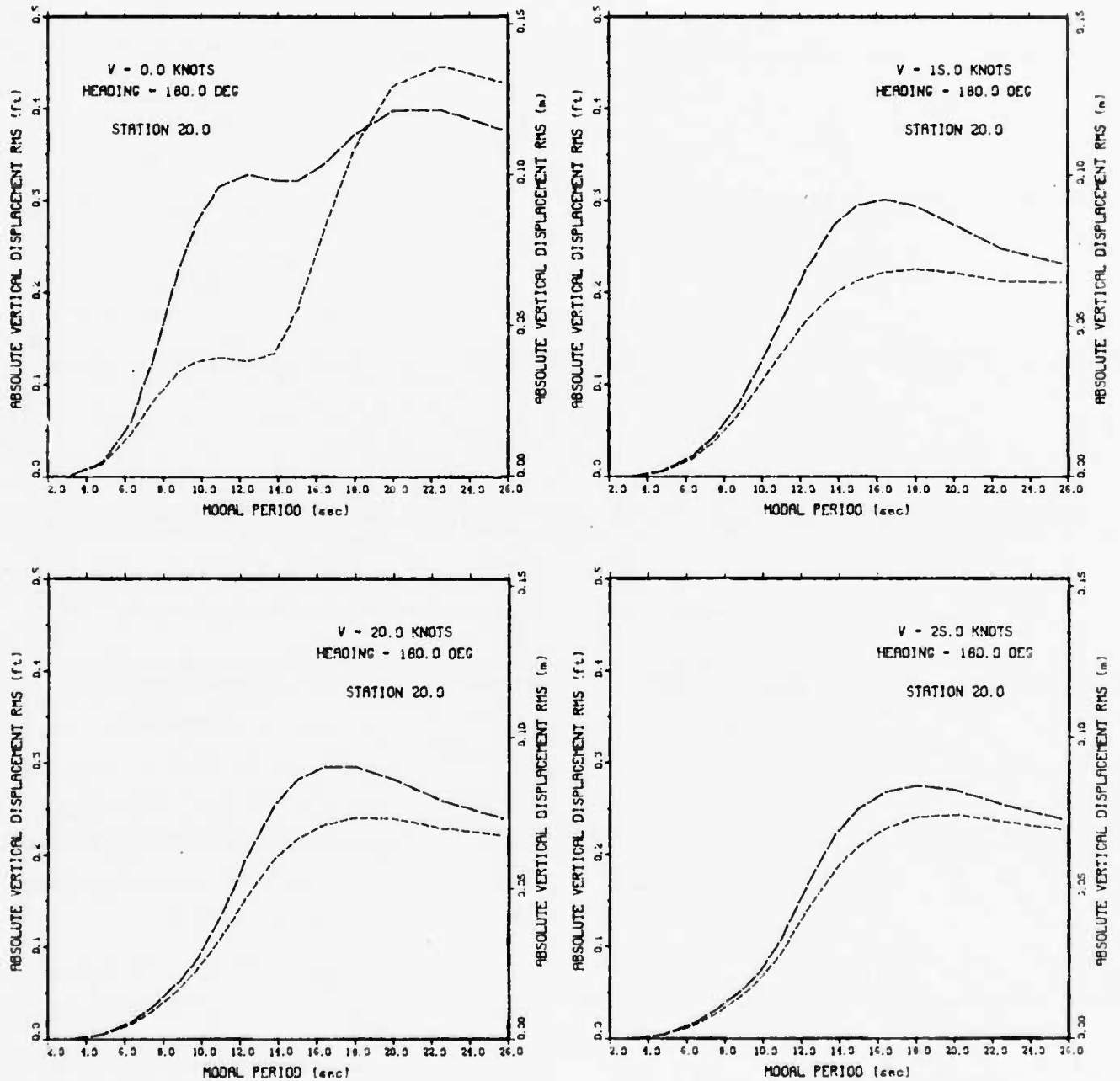


Figure 5u - Responses for Configurations 3132 and 3133

FIGURE 5 - CONTINUED

3211 —————
3212 - - - - -
3213 - - - - -

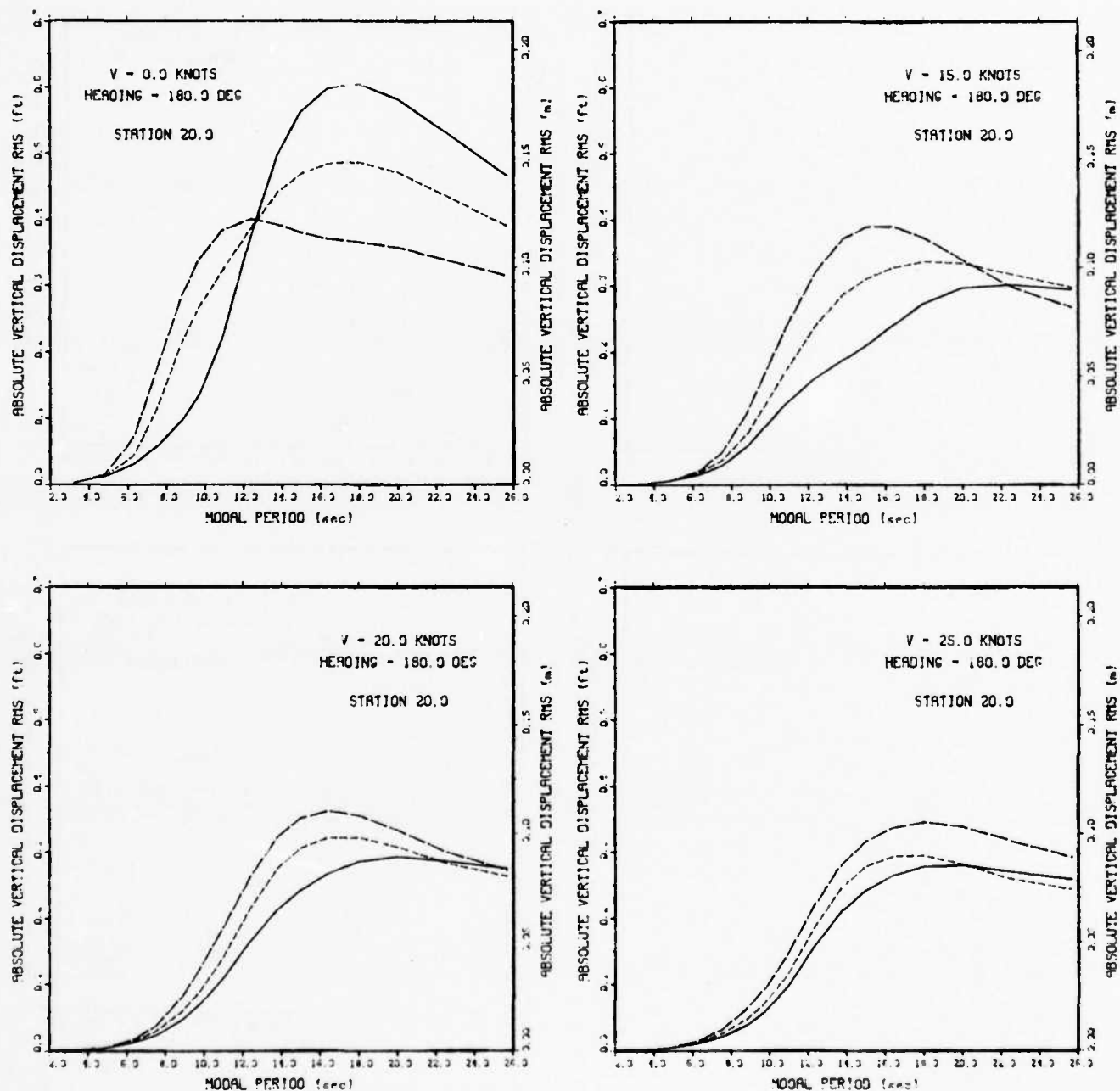


Figure 5v - Responses for Configurations 3211, 3212, and 3213

FIGURE 5 - CONTINUED

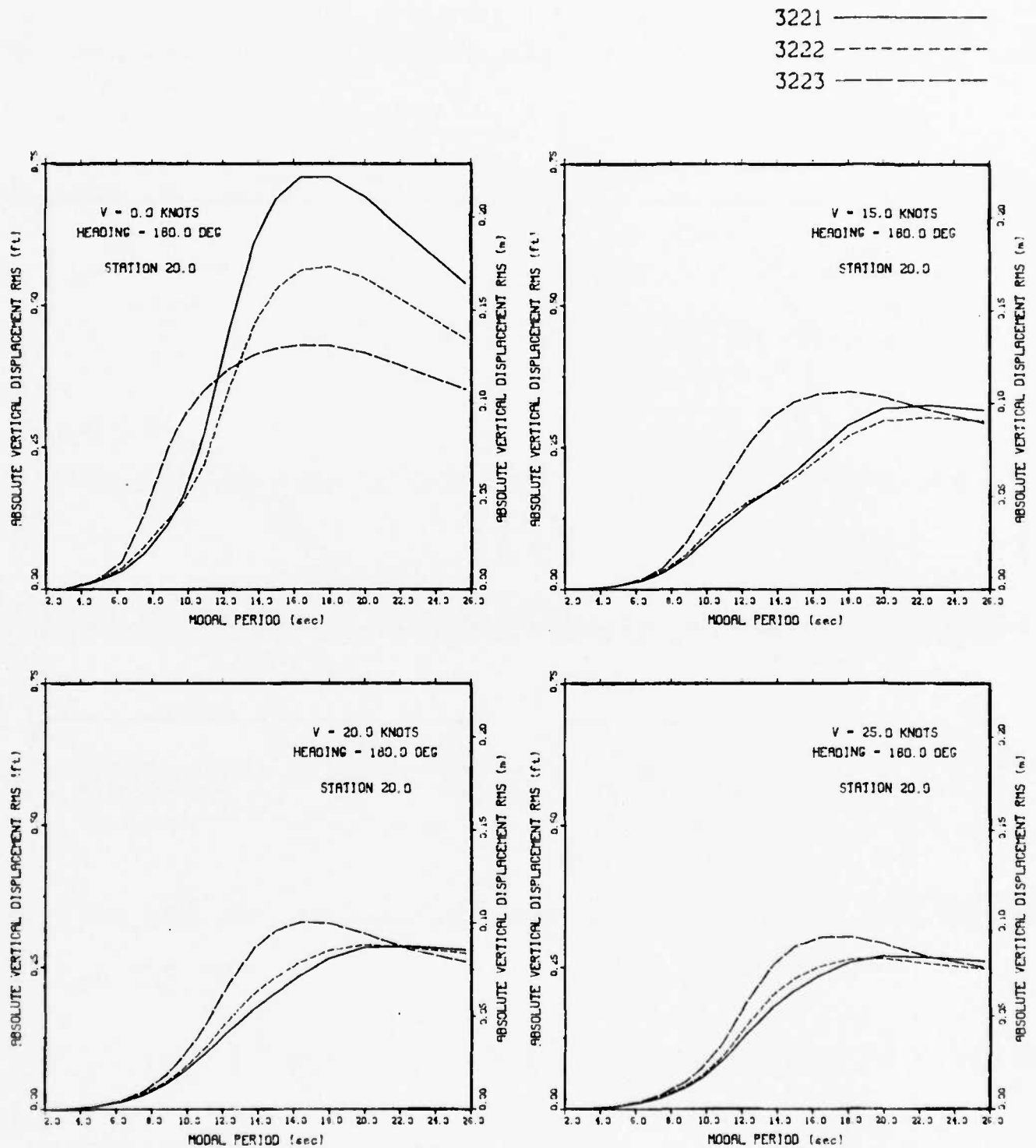


Figure 5w - Responses for Configurations 3221, 3222, and 3223

FIGURE 5 - CONTINUED

3231 —————
 3232 - - - - -
 3233 - - - - -

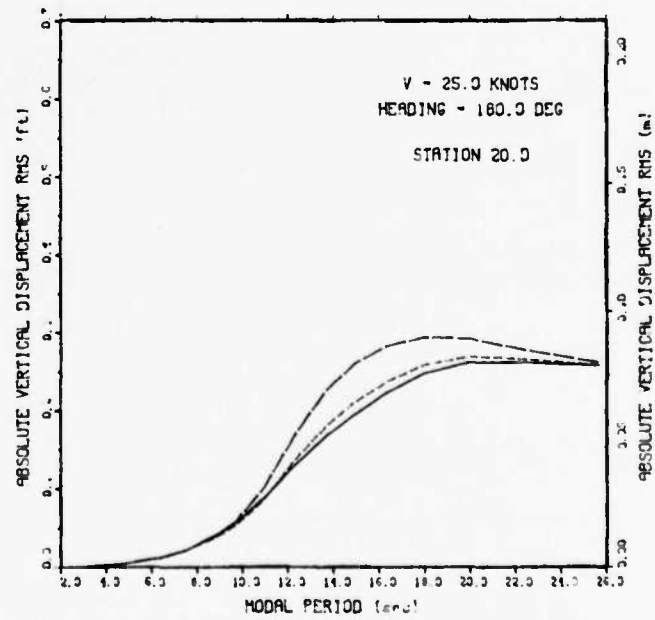
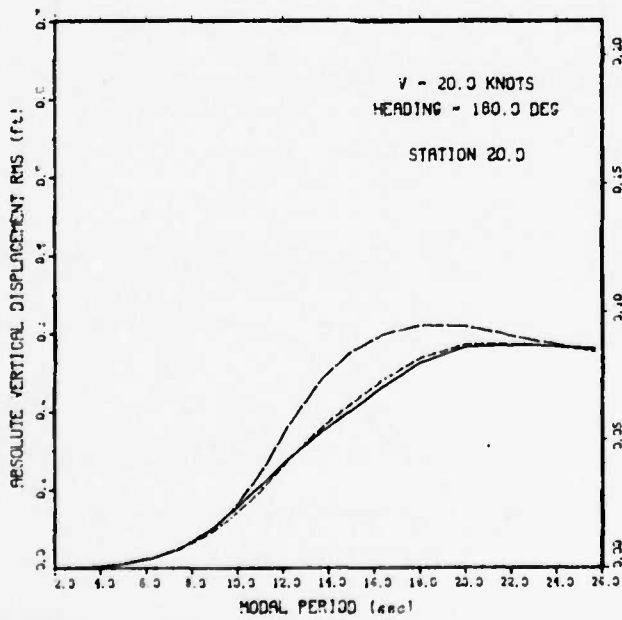
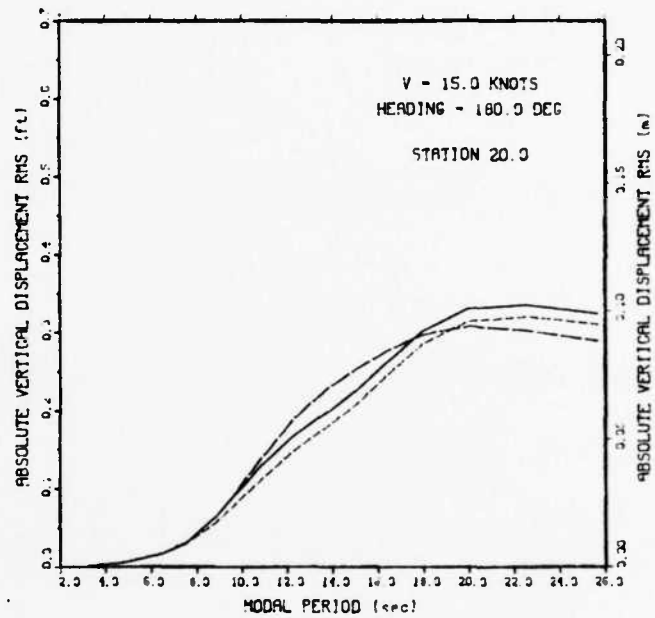
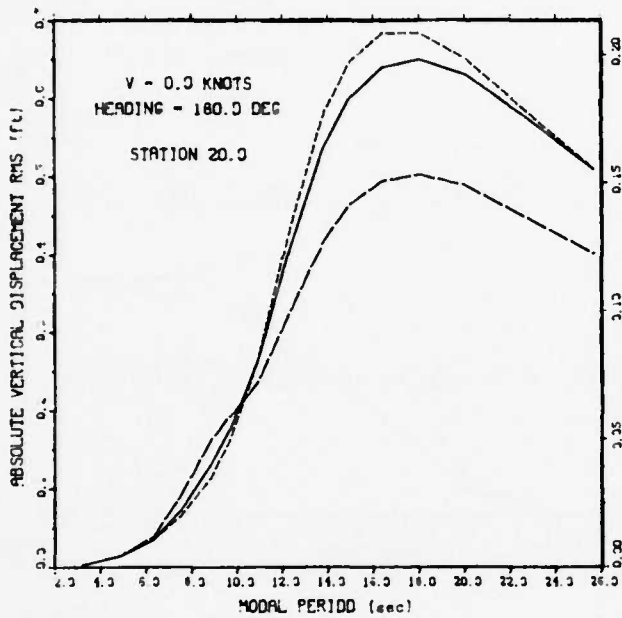


Figure 5x - Responses for Configurations 3231, 3232, and 3233

FIGURE 5 - CONTINUED

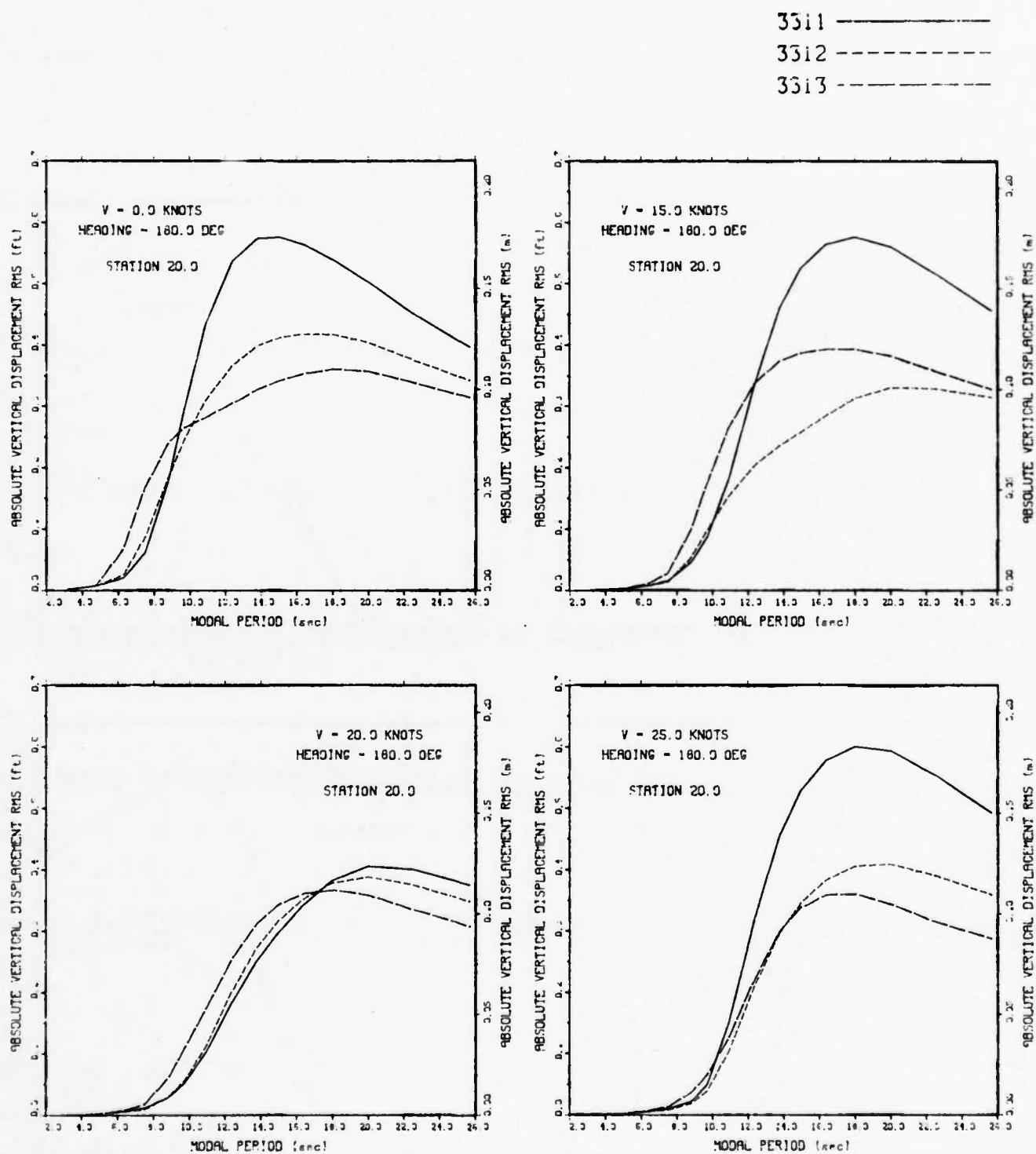


Figure 5y - Responses for Configurations 3311, 3312, and 3313

FIGURE 5 - CONTINUED

3321 —————
 3322 - - - - -
 3323 ————

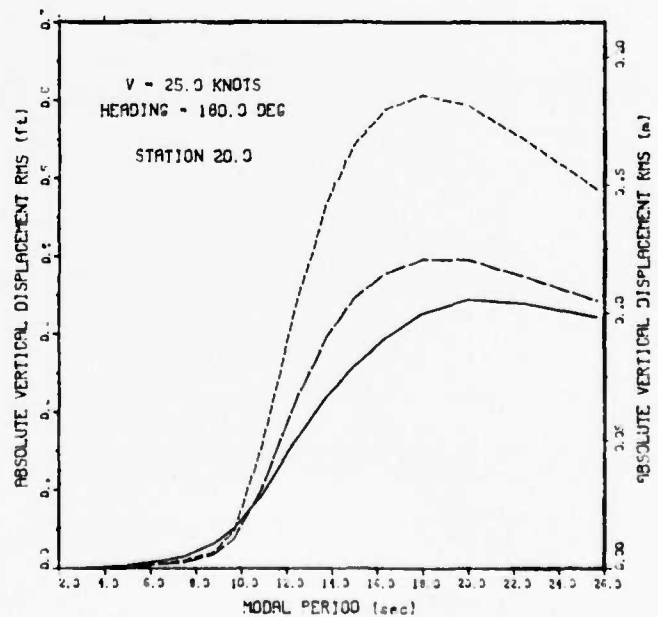
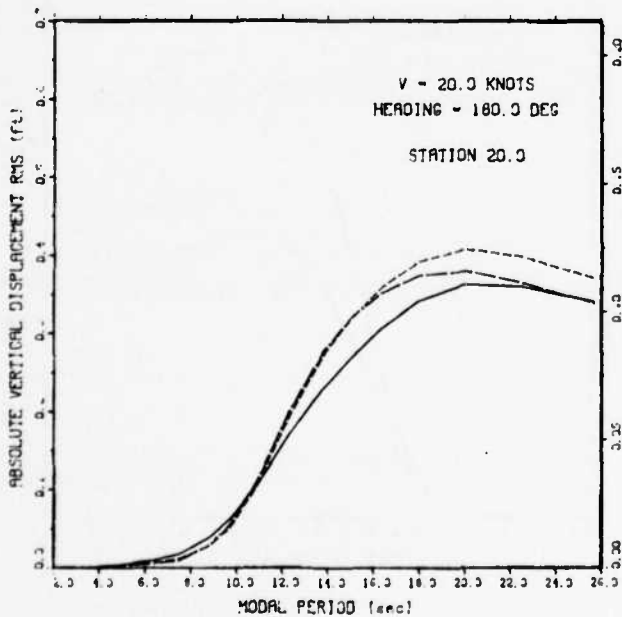
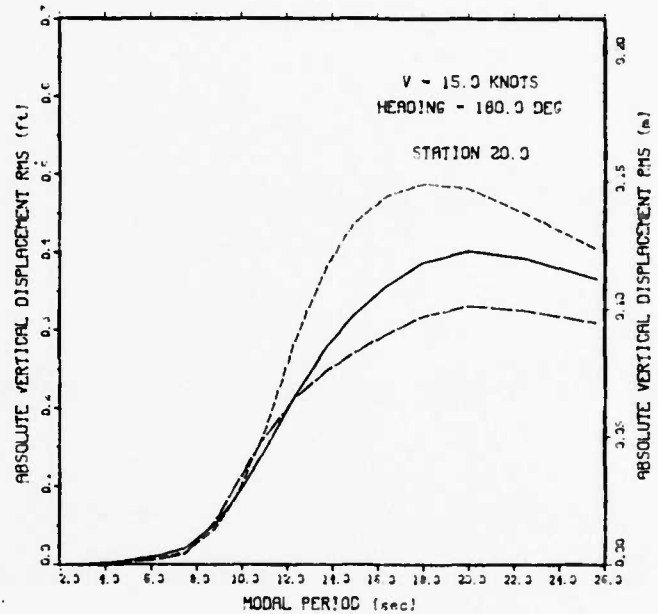
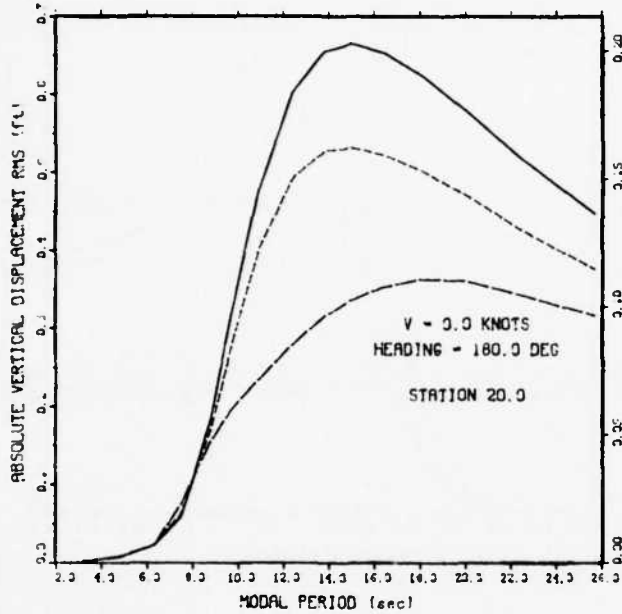


Figure 5z - Responses for Configurations 3321, 3322, and 3323

FIGURE 5 - CONTINUED

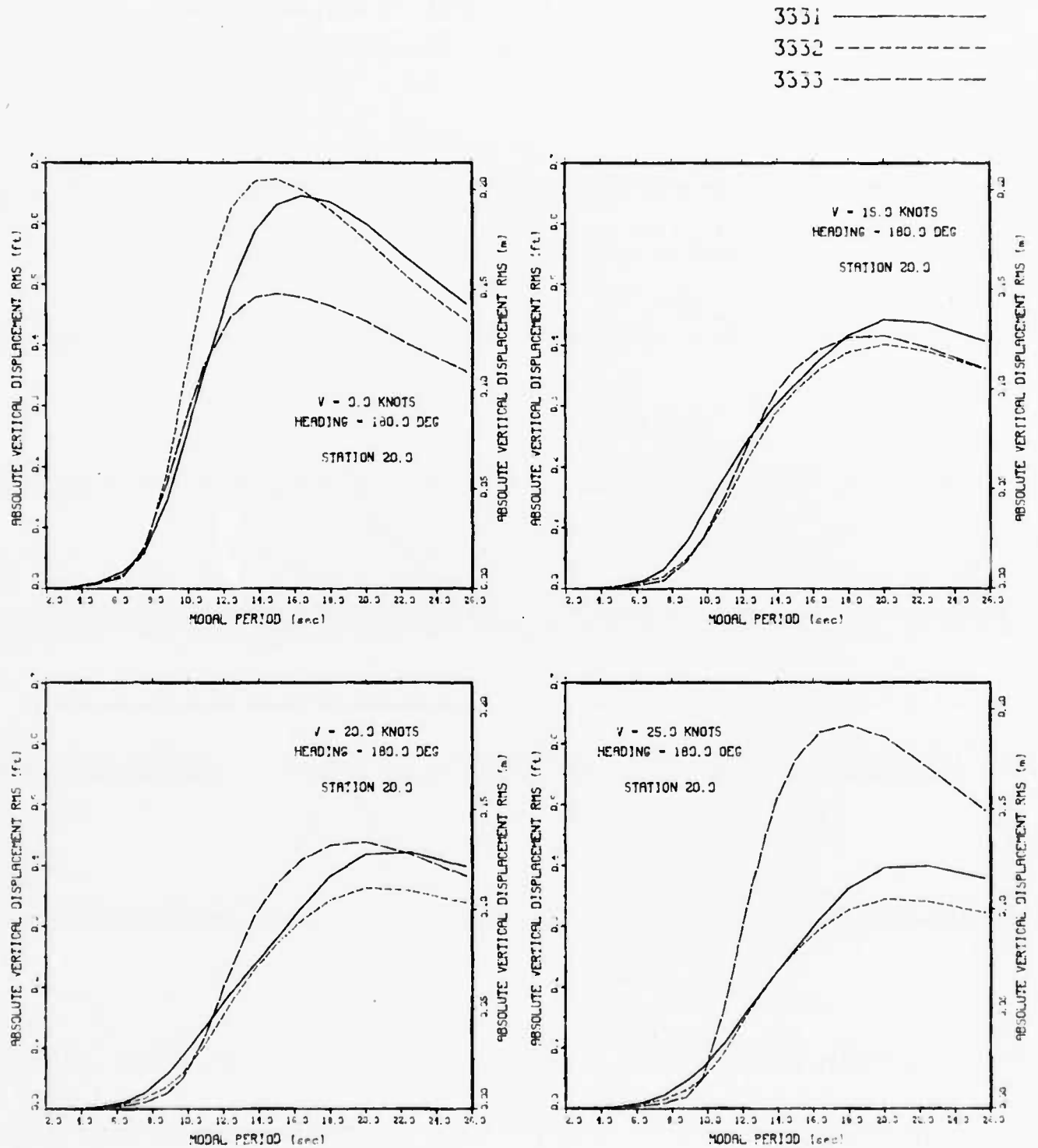


Figure 5aa - Responses for Configurations 3331, 3332, and 3333

FIGURE 6 - HEAVE RMS RESPONSES IN FOLLOWING SEAS

1111 —————
1112 - - - - -
1113 - - - - -

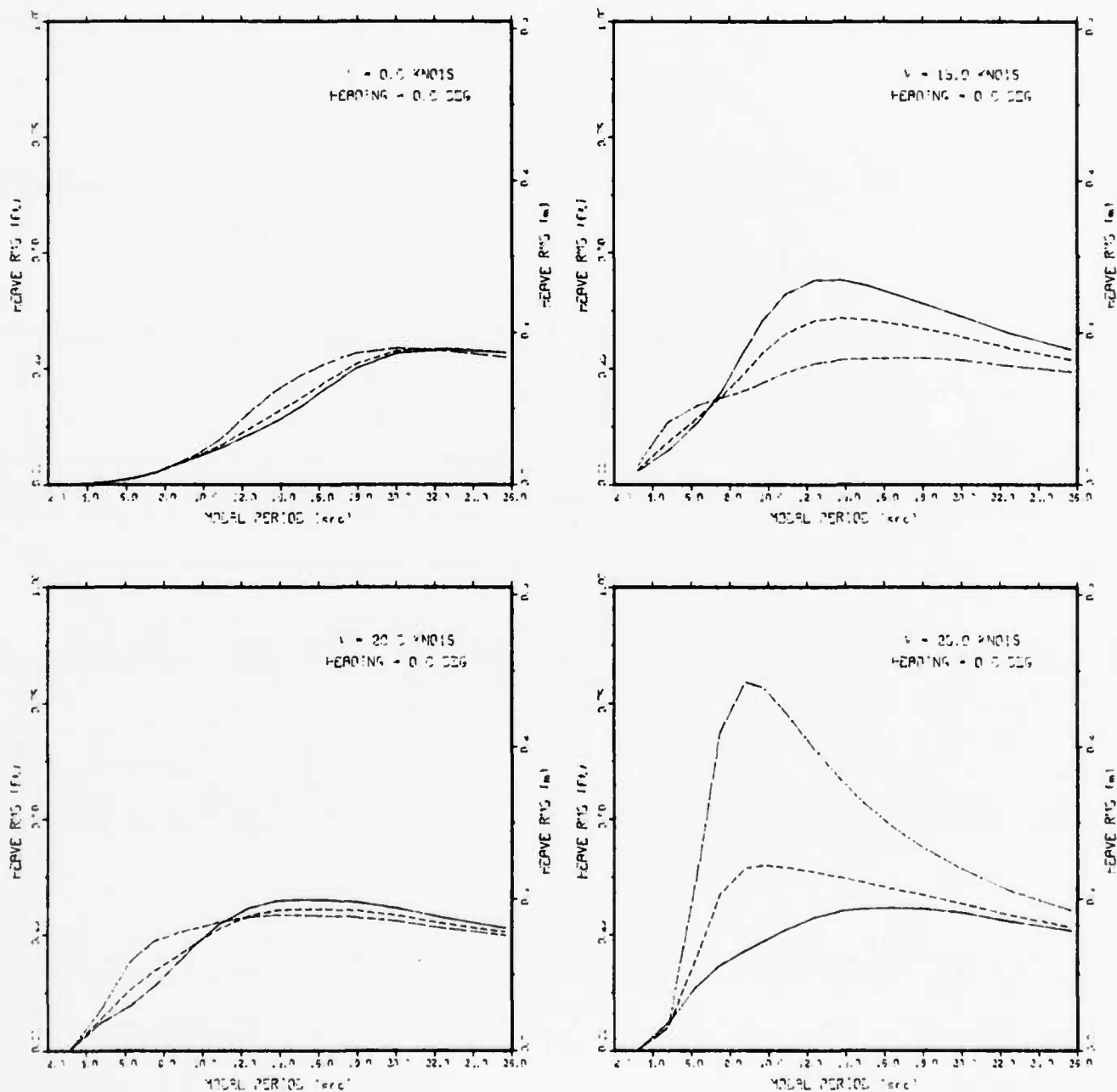


Figure 6a - Responses for Configurations 1111, 1112, and 1113

FIGURE 6 - CONTINUED

1121 —————
 1122 - - - - -
 1123 - - - - -

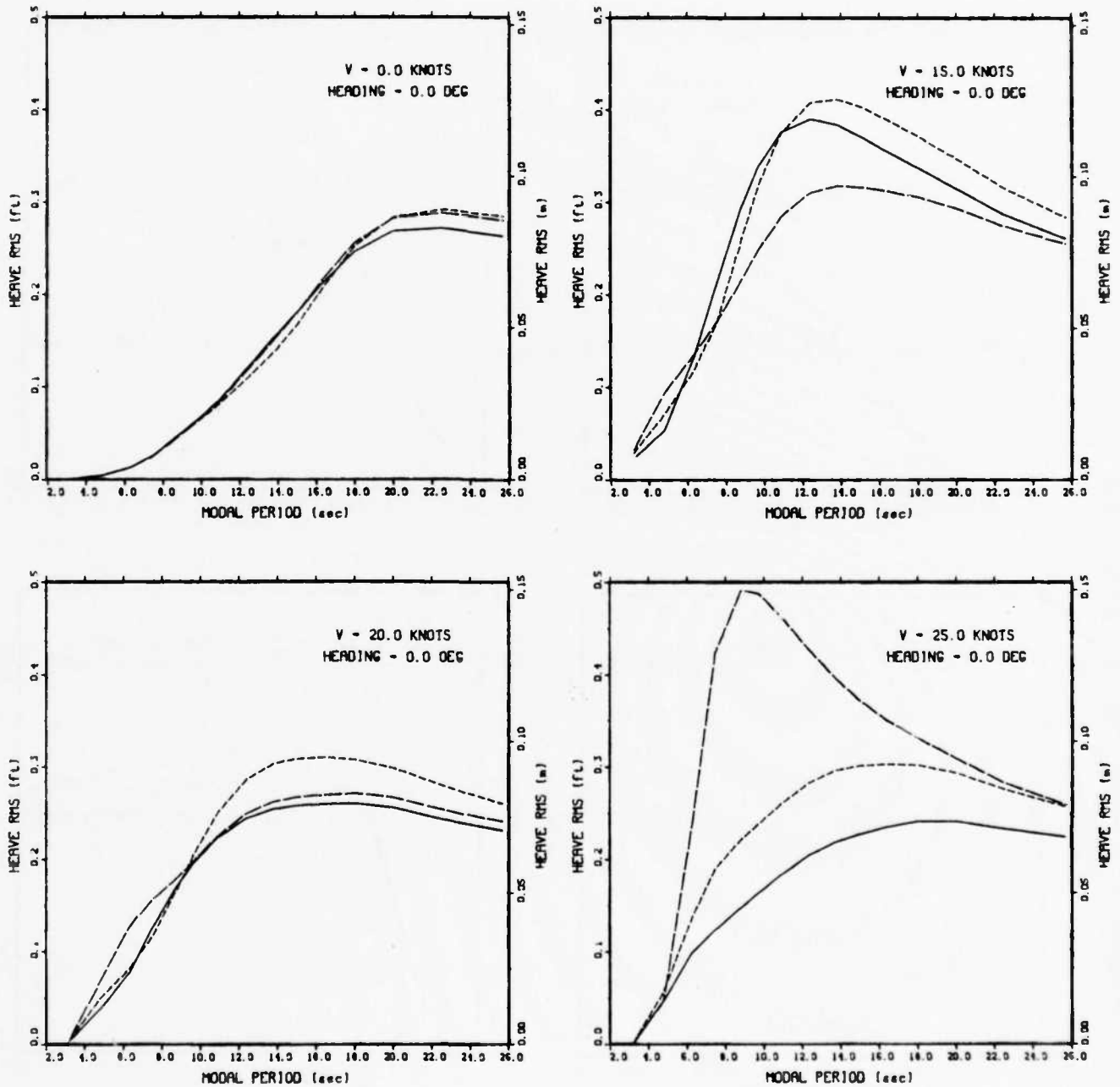


Figure 6b - Responses for Configurations 1121, 1122, and 1123

FIGURE 6 - CONTINUED

1131 —————
1132 - - - - -
1133 - - - - -

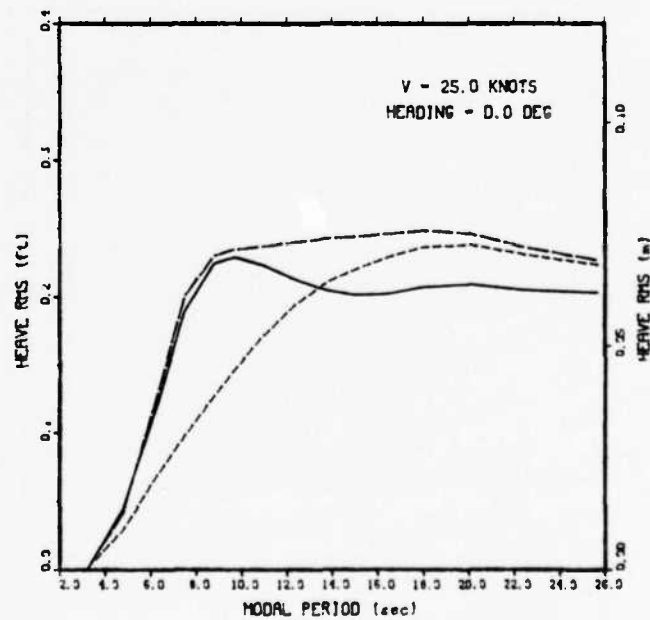
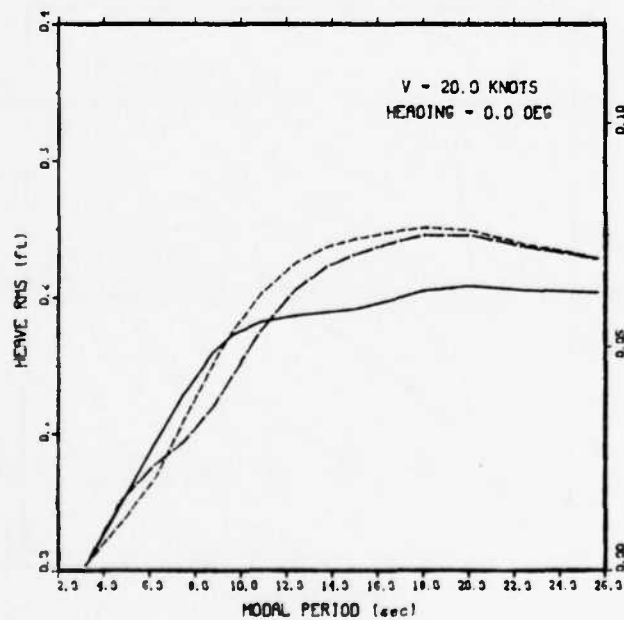
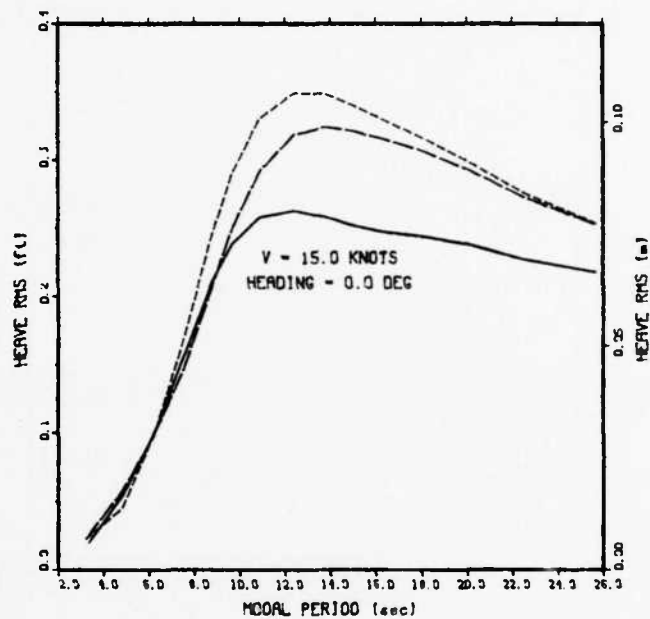
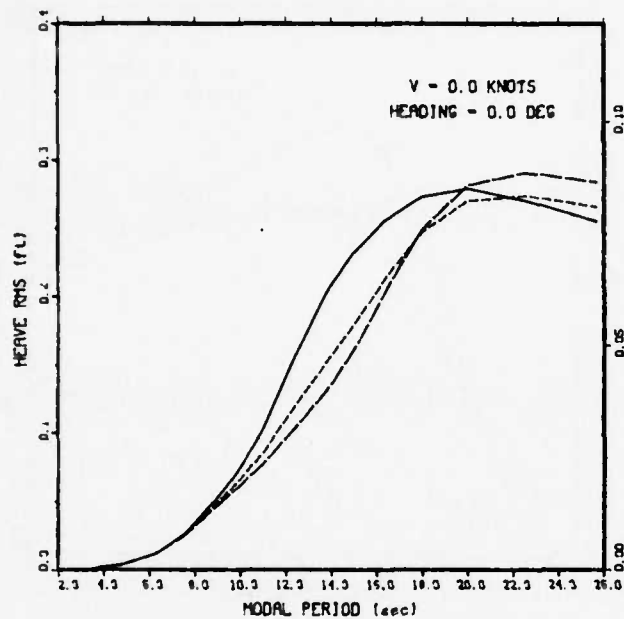


Figure 6c - Responses for Configurations 1131, 1132, and 1133

FIGURE 6 - CONTINUED

1211 —————
1212 - - - - -
1213 - - - - -

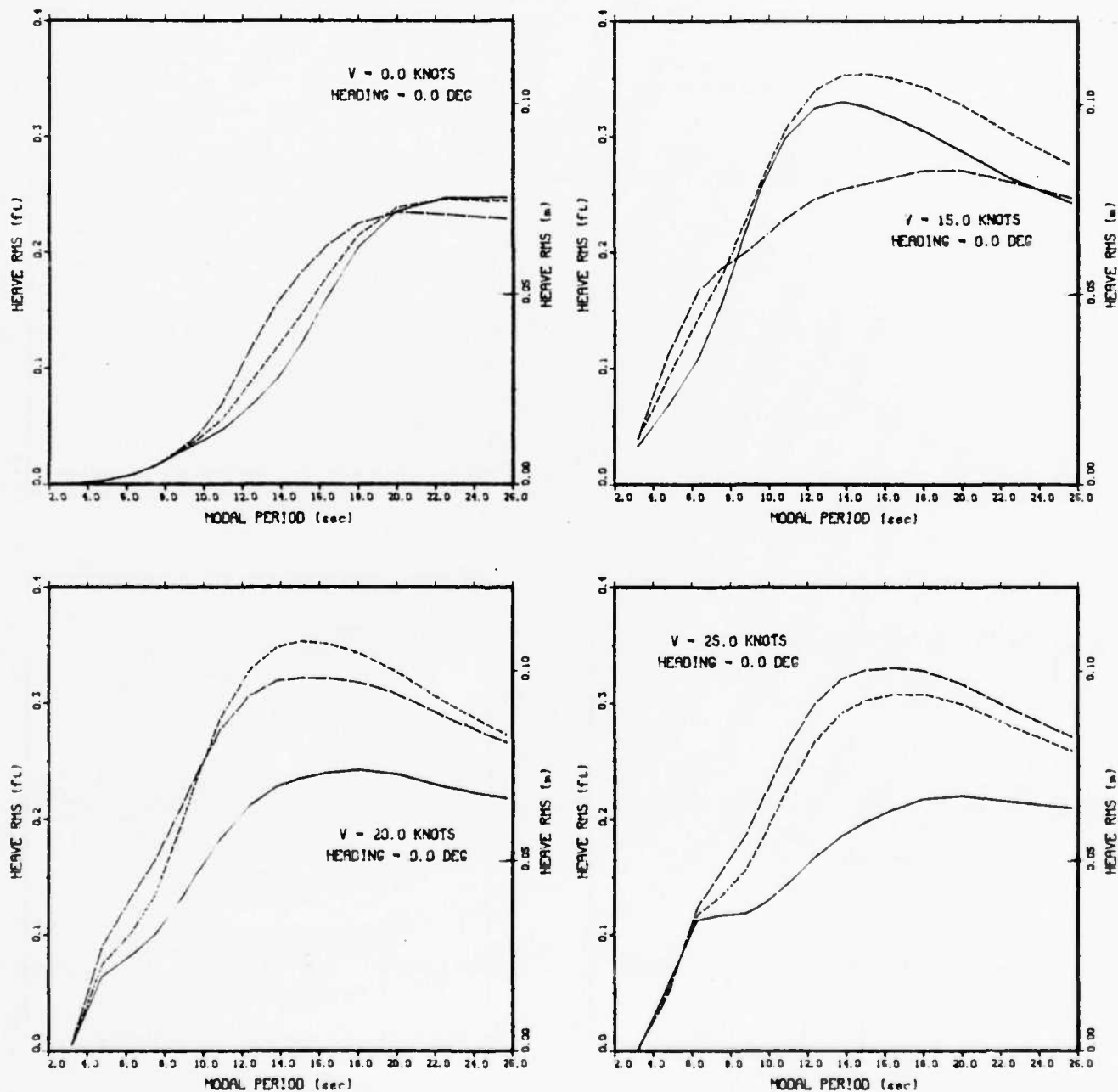


Figure 6d - Responses for Configurations 1211, 1212, and 1213

FIGURE 6 - CONTINUED

1221 —————
 1222 - - - - -
 1223 - - - - -

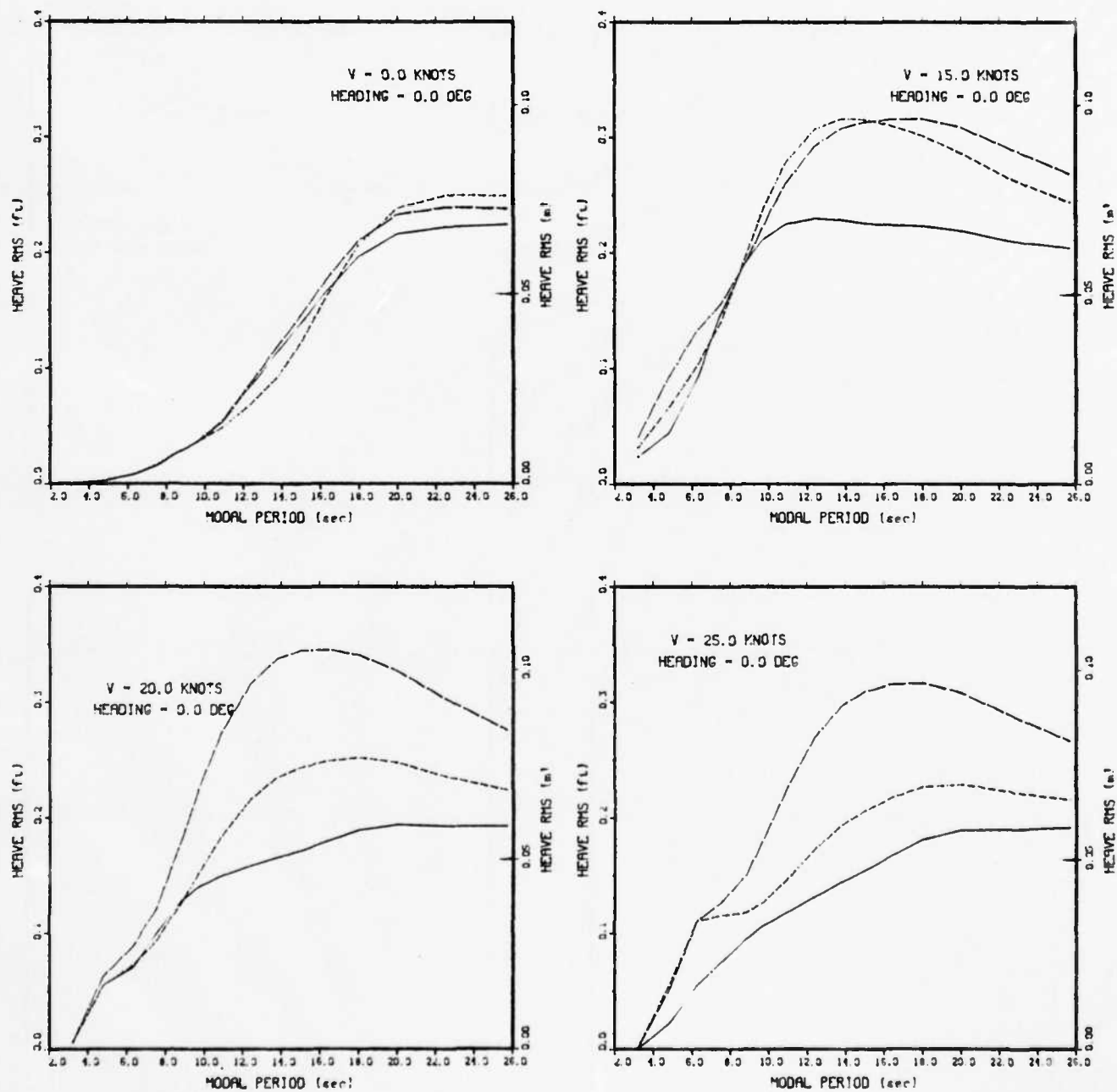


Figure 6e - Responses for Configurations 1221, 1222, and 1223

FIGURE 6 - CONTINUED

1231 —————
1232 - - - - -
1233 - - - - -

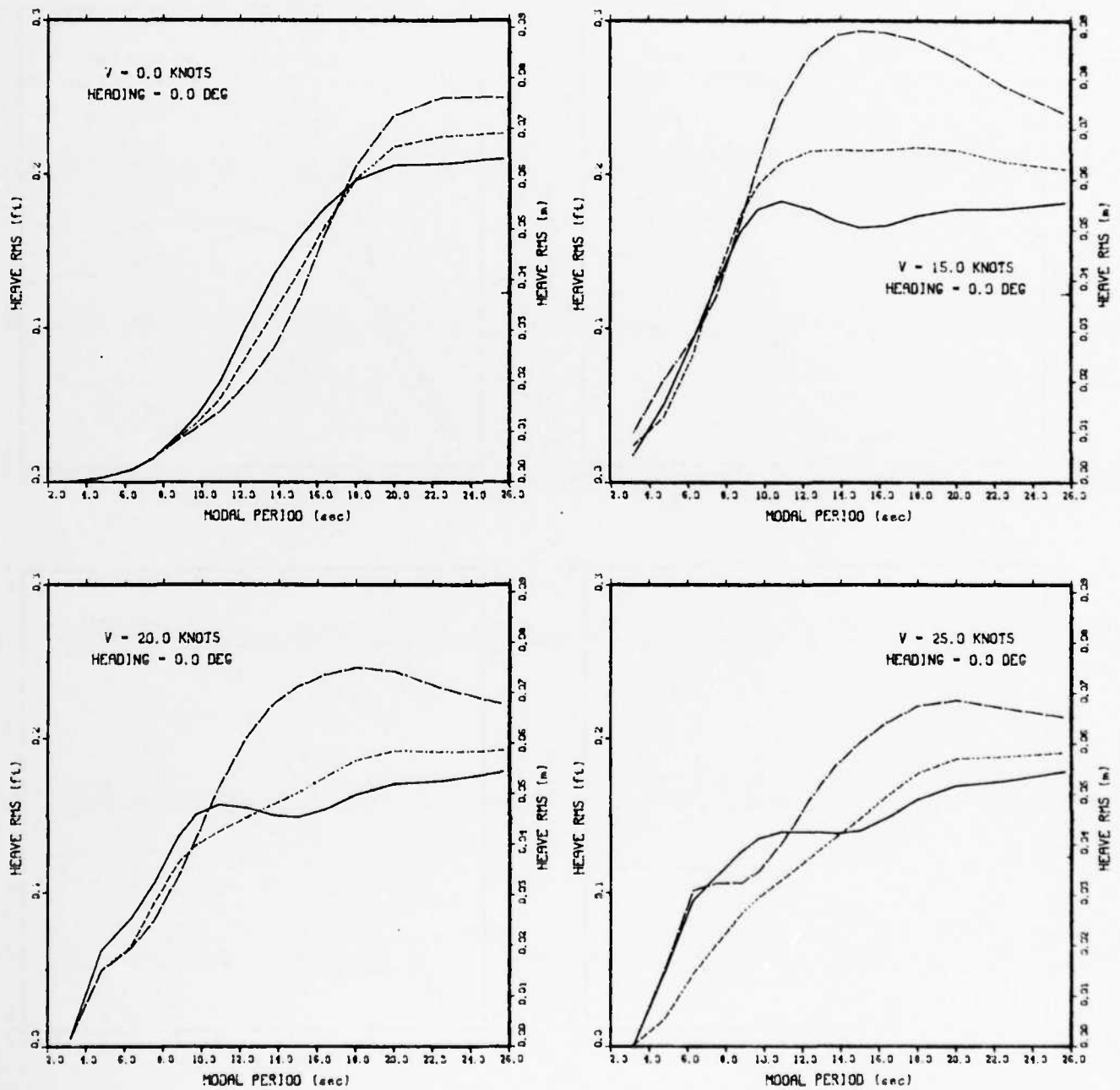


Figure 6f - Responses for Configurations 1231, 1232, and 1233

FIGURE 6 - CONTINUED

1311 —————
 1312 - - - - -
 1313 - · - · -

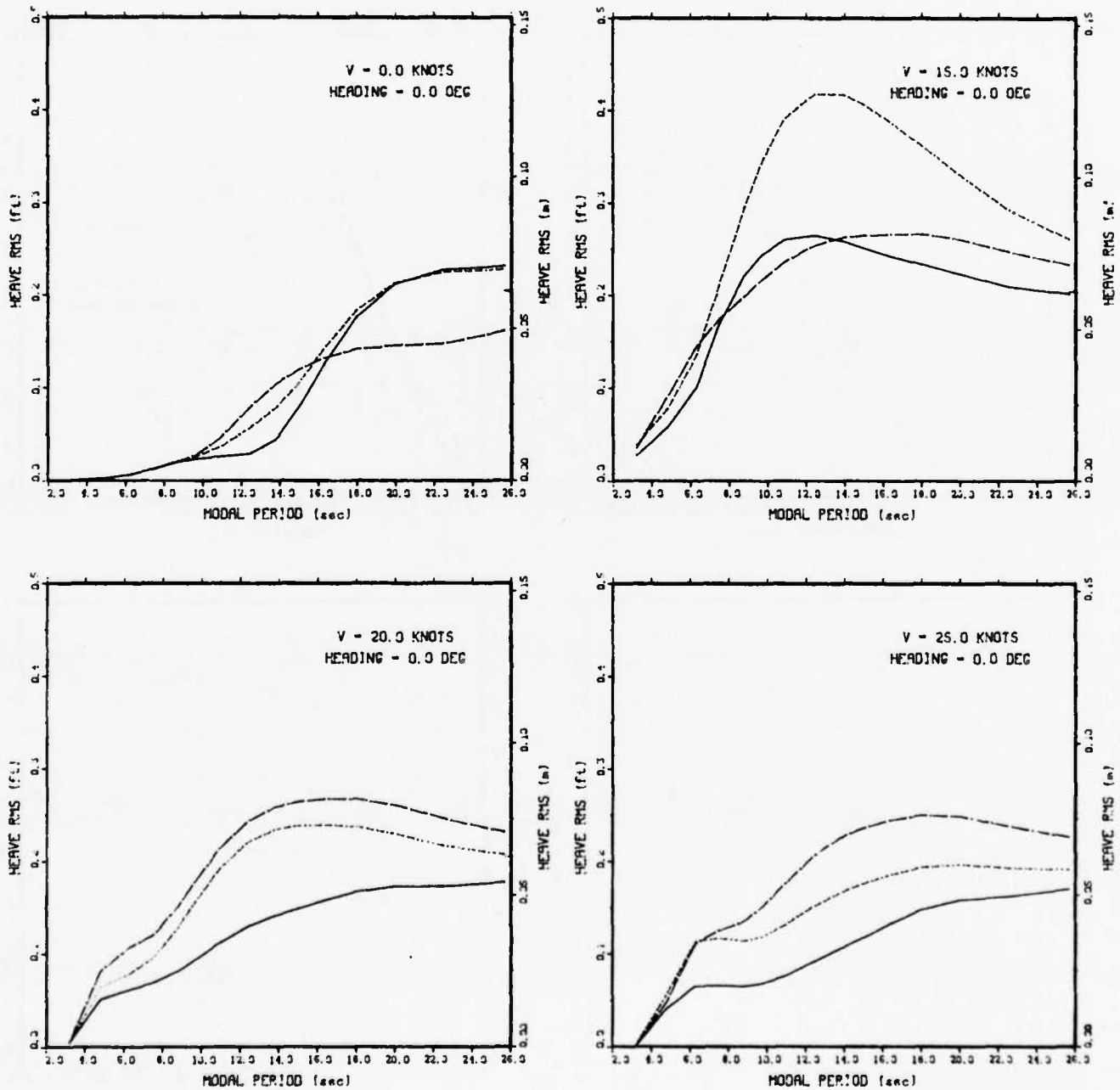


Figure 6g - Responses for Configurations 1311, 1312, and 1313

FIGURE 6 - CONTINUED

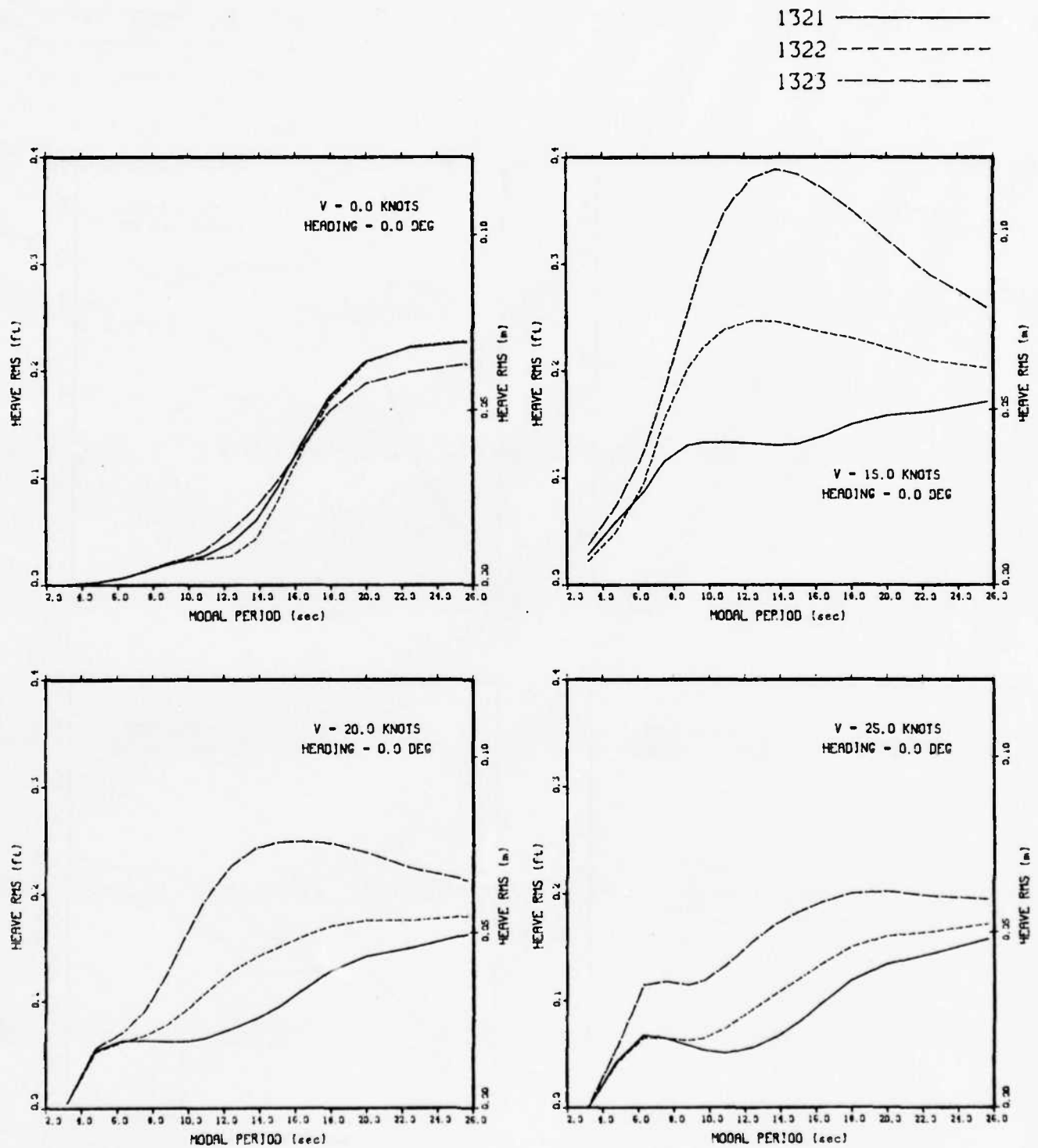


Figure 6h - Responses for Configurations 1321, 1322, and 1323

FIGURE 6 - CONTINUED

1331 ———
1332 - - -
1333 - - -

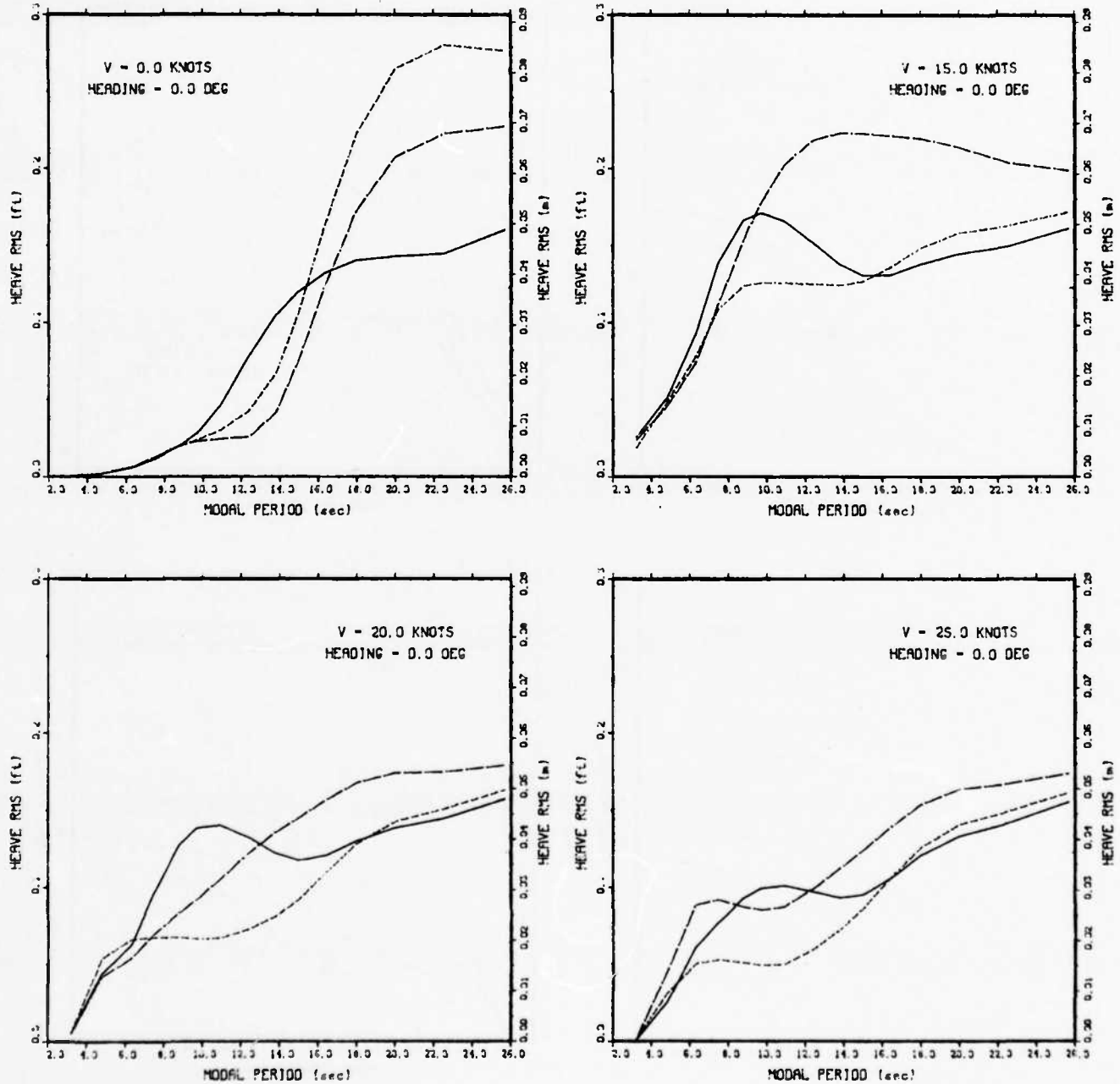


Figure 61 - Responses for Configurations 1331, 1332, and 1333

FIGURE 6 - CONTINUED

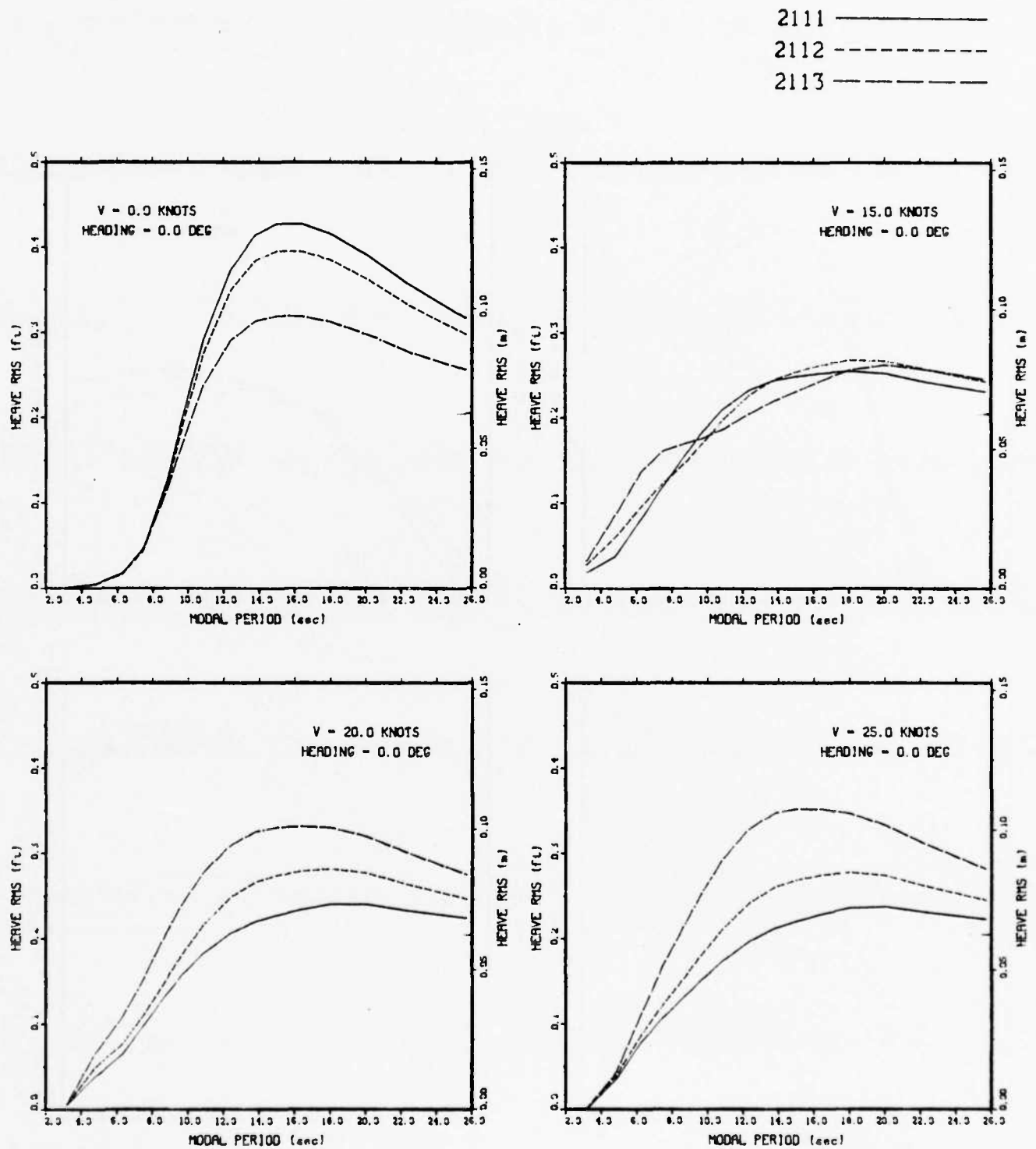


Figure 6j - Responses for Configurations 2111, 2112, and 2113

FIGURE 6 - CONTINUED

2121 —————
 2122 - - - - -
 2123 - · - · -

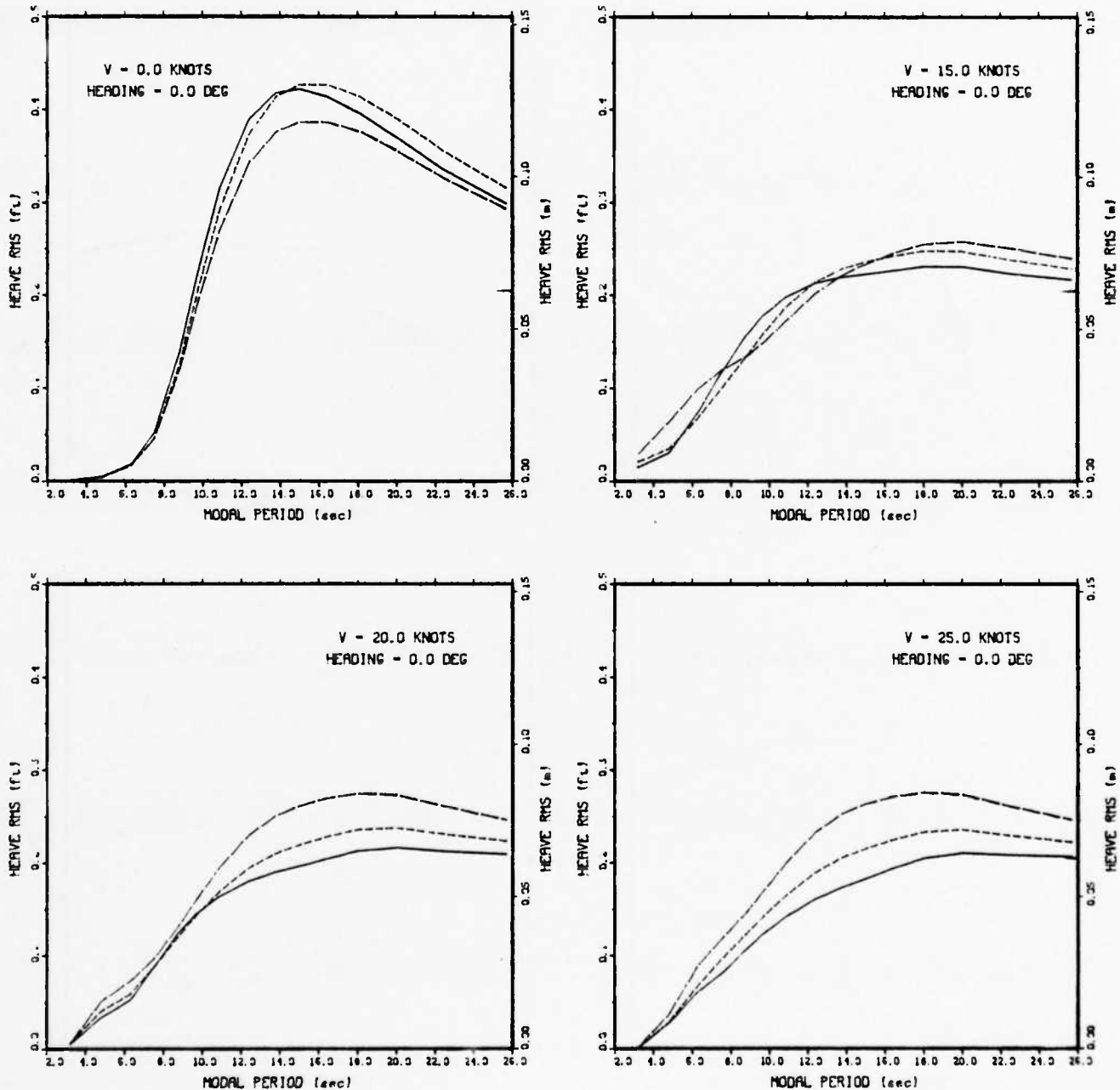


Figure 6k - Responses for Configurations 2121, 2122, and 2123

FIGURE 6 - CONTINUED

2132 - - - - -
2133 - - - - -

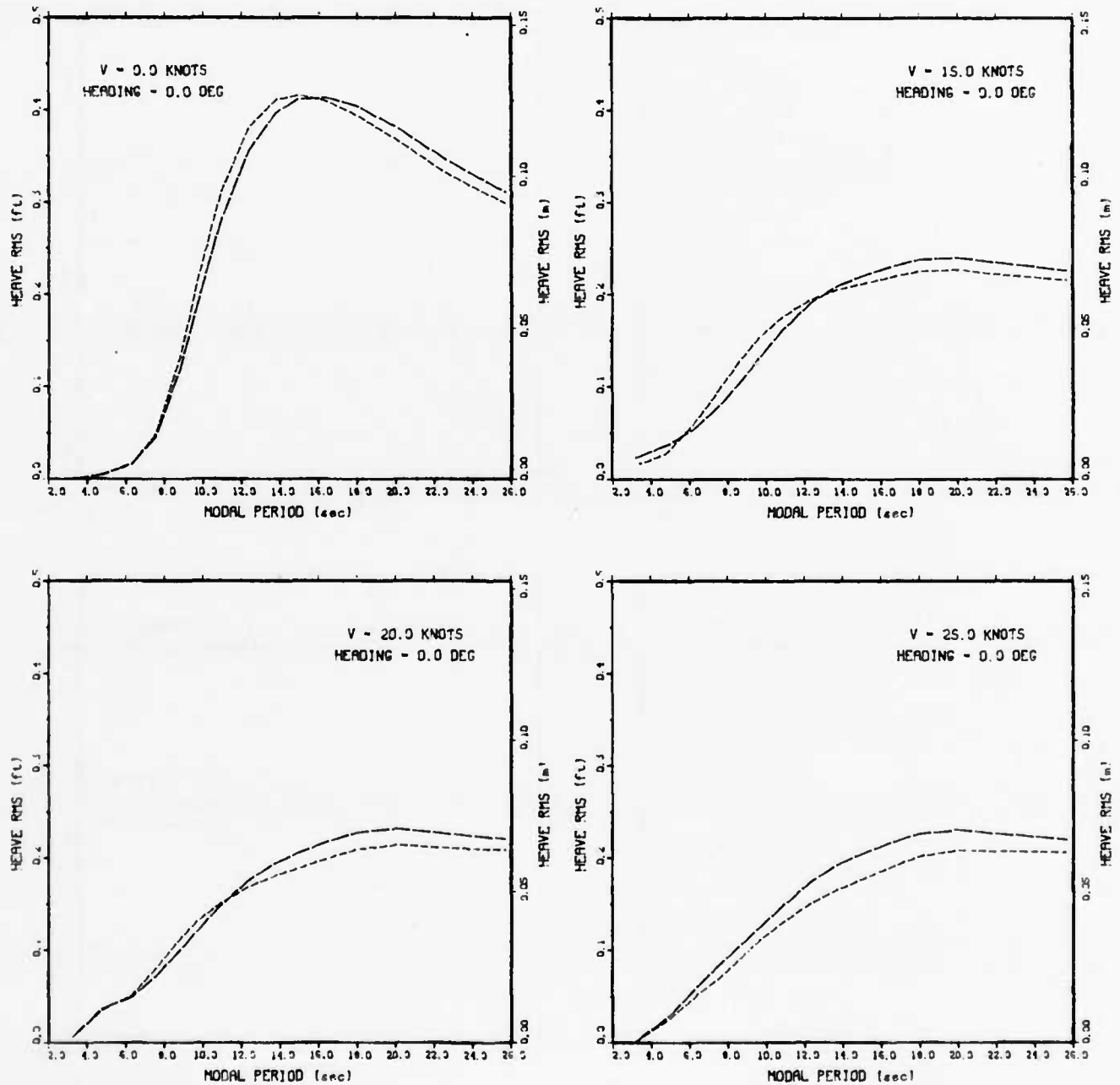


Figure 61 - Responses for Configurations 2132 and 2133

FIGURE 6 - CONTINUED

2211 ———
2212 - - -
2213 - - -

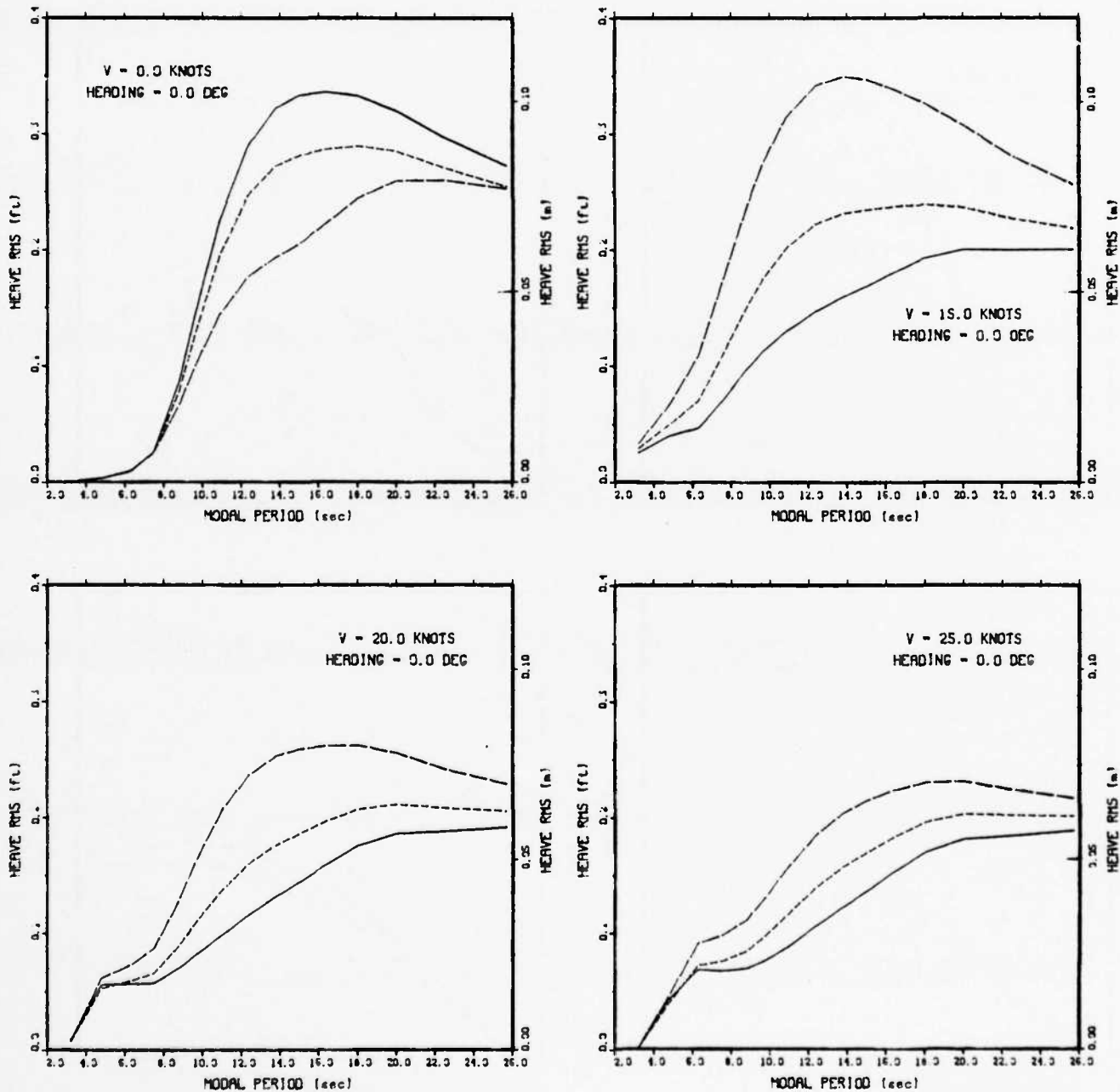


Figure 6m - Responses for Configurations 2211, 2212, and 2213

FIGURE 6 - CONTINUED

2221 - - - - -
2222 - - - - -
2223 - - - - -

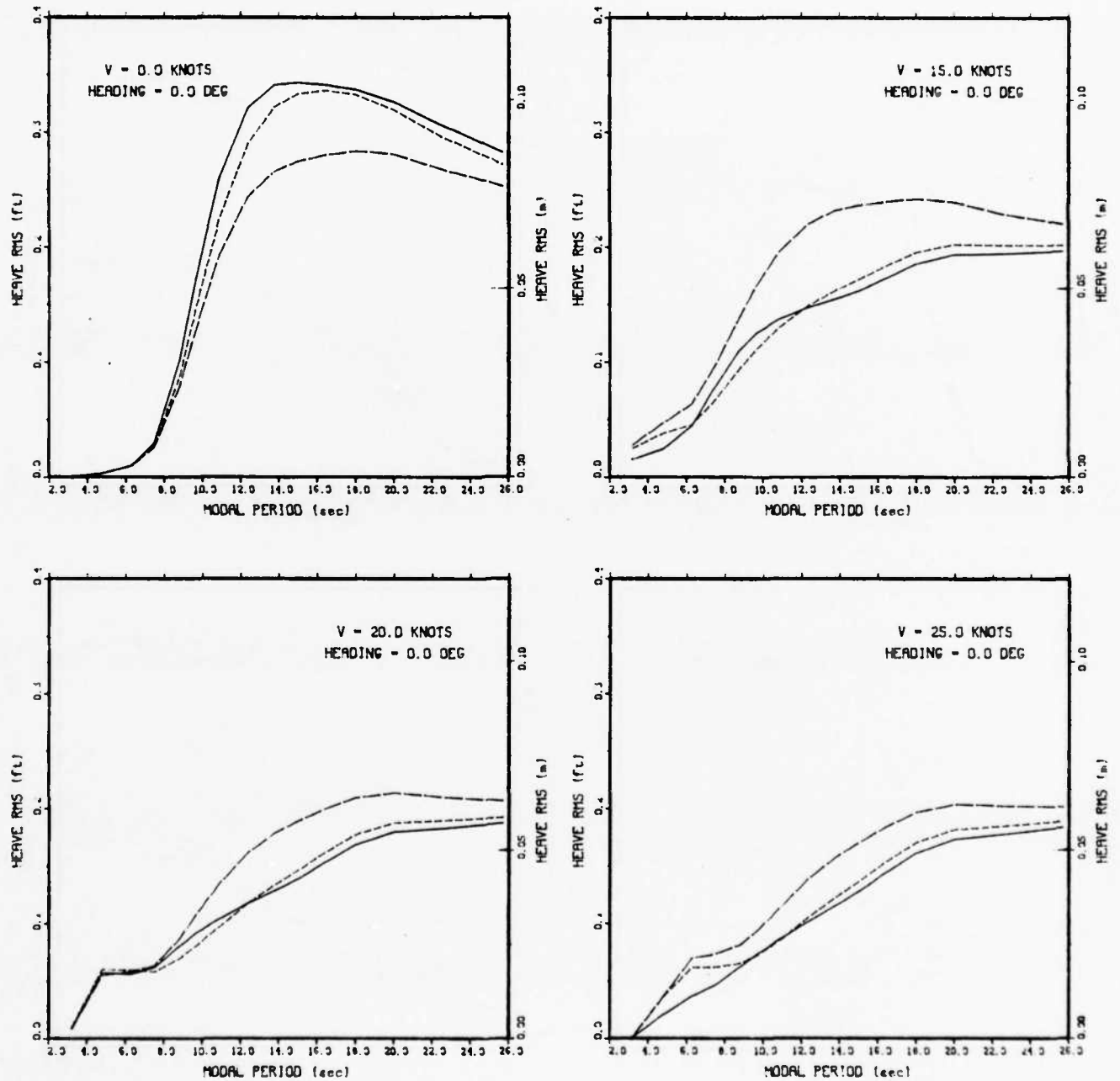


Figure 6n - Responses for Configurations 2221, 2222, and 2223

FIGURE 6 - CONTINUED

2231 —————
 2232 - - - - -
 2233 - - - - -

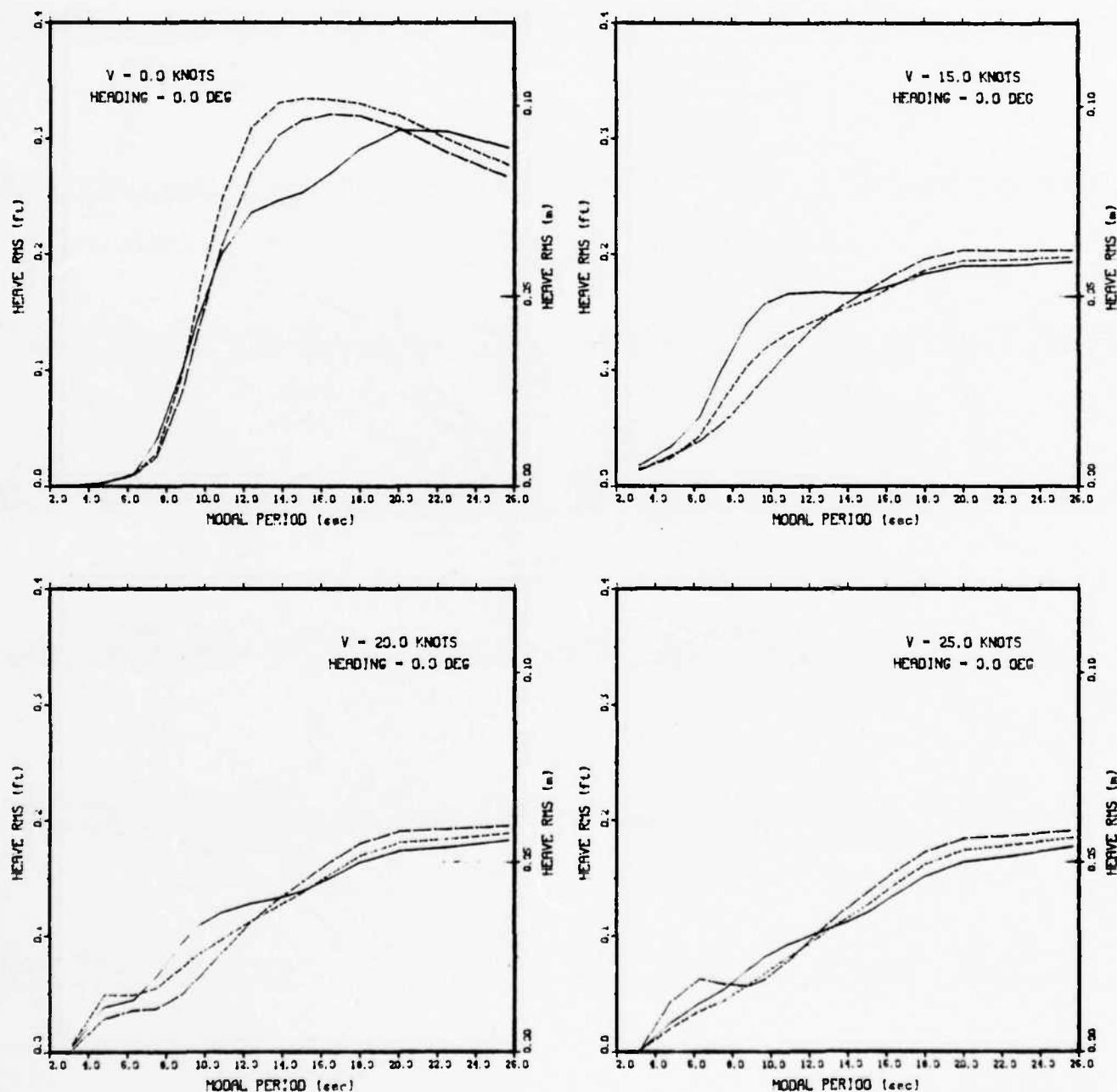


Figure 6a - Responses for Configurations 2231, 2232, and 2233

FIGURE 6 - CONTINUED

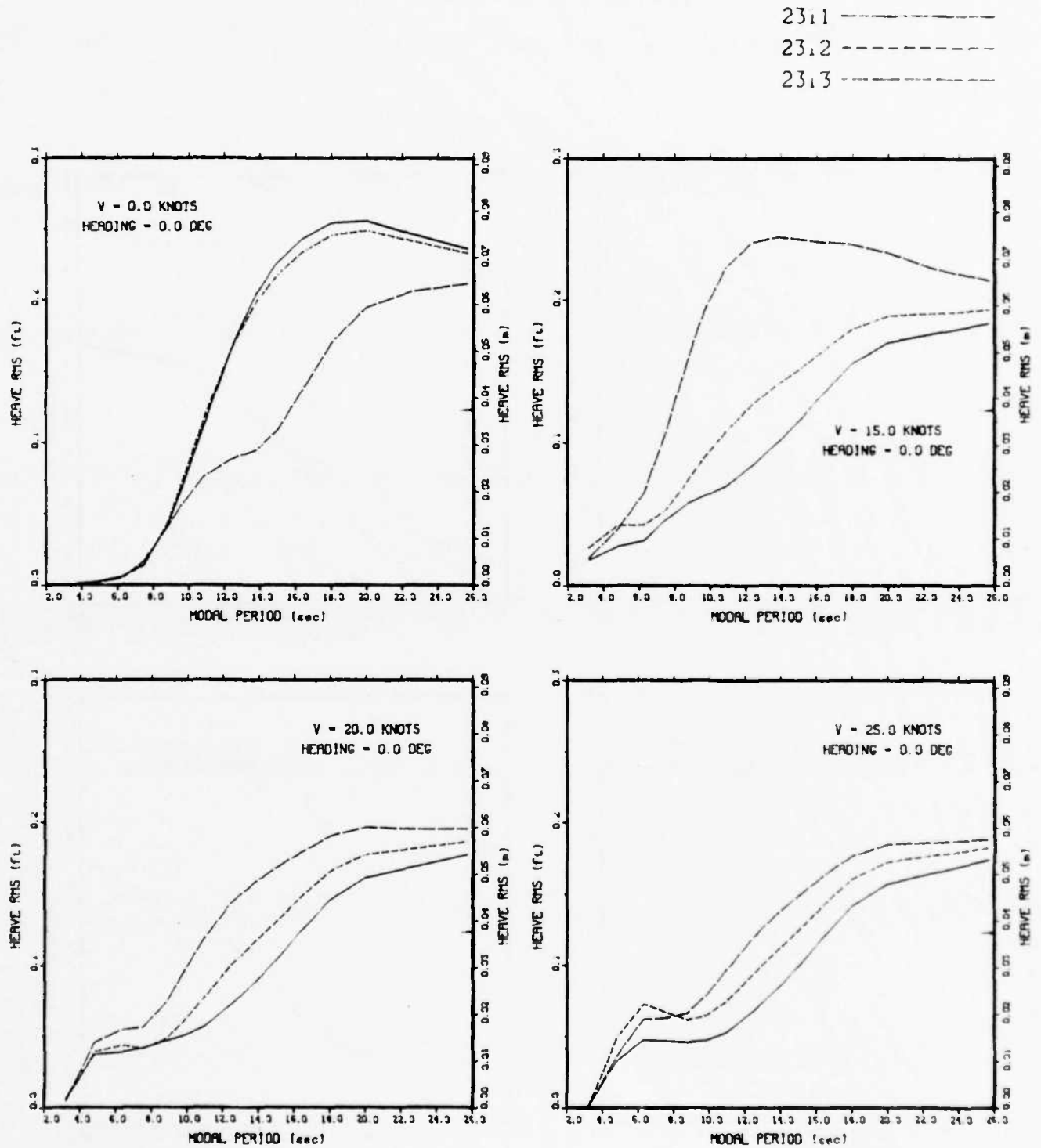


Figure 6p - Responses for Configurations 2311, 2312, and 2313

FIGURE 6 - CONTINUED

2321 —————
 2322 - - - - -
 2323 - · - · - ·

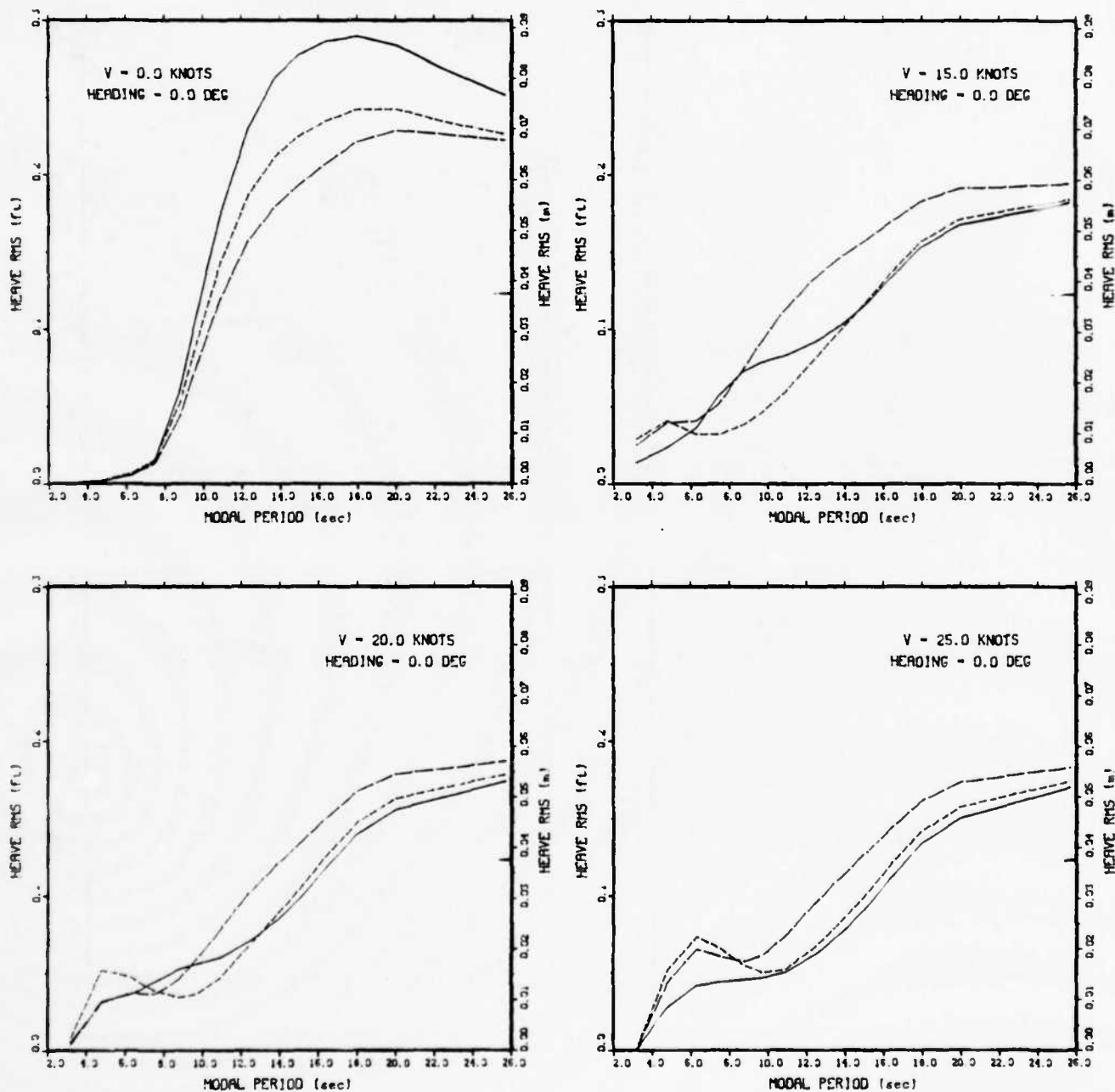


Figure 6q - Responses for Configurations 2321, 2322, and 2323

FIGURE 6 - CONTINUED

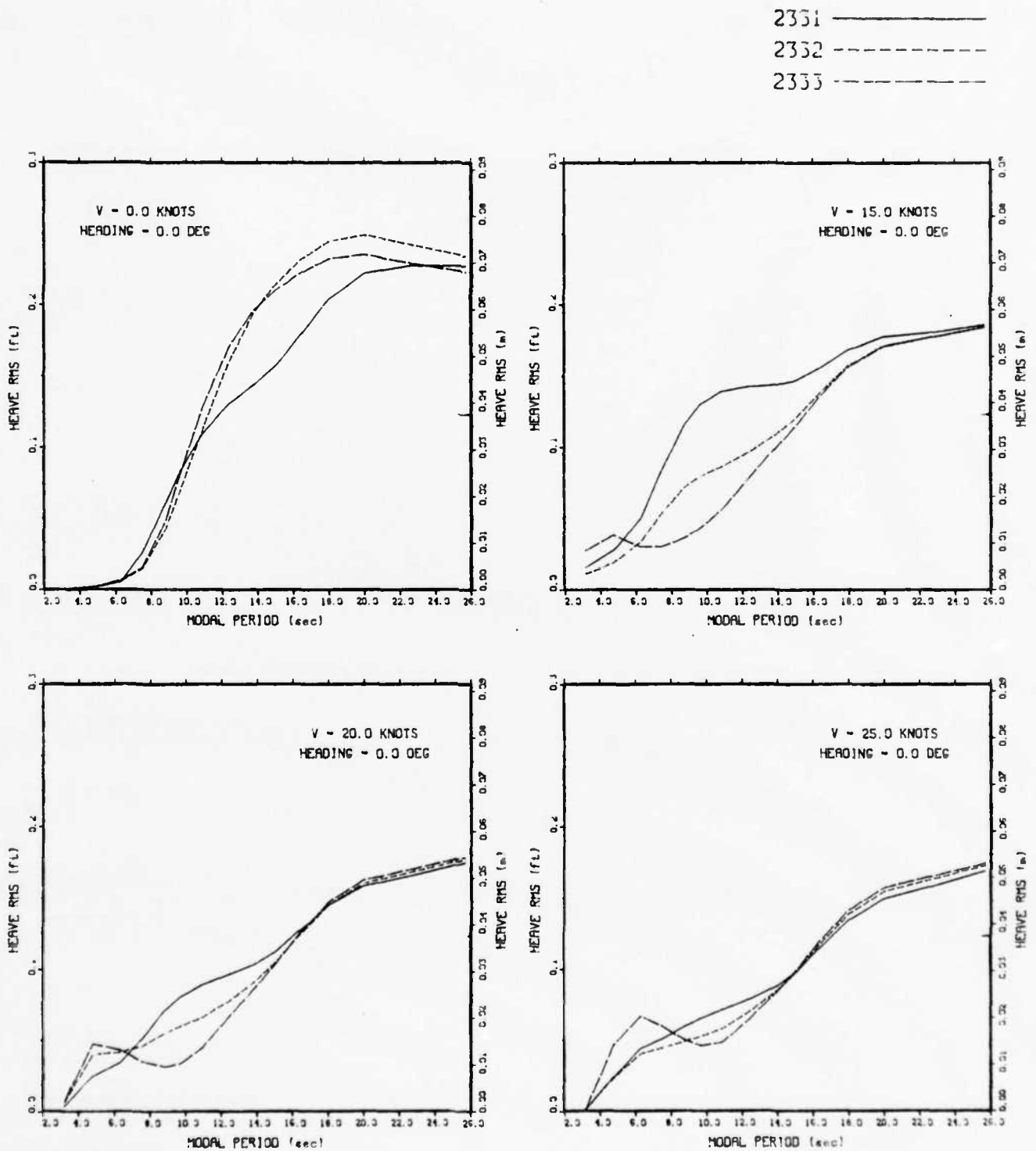


Figure 6r - Responses for Configurations 2331, 2332, and 2333

FIGURE 6 - CONTINUED

3111 —————
 3112 - - - - -
 3113 - - - - -

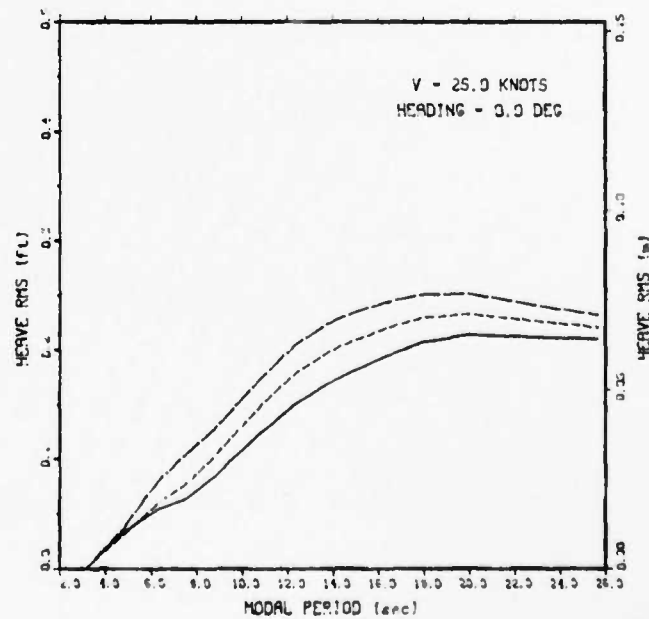
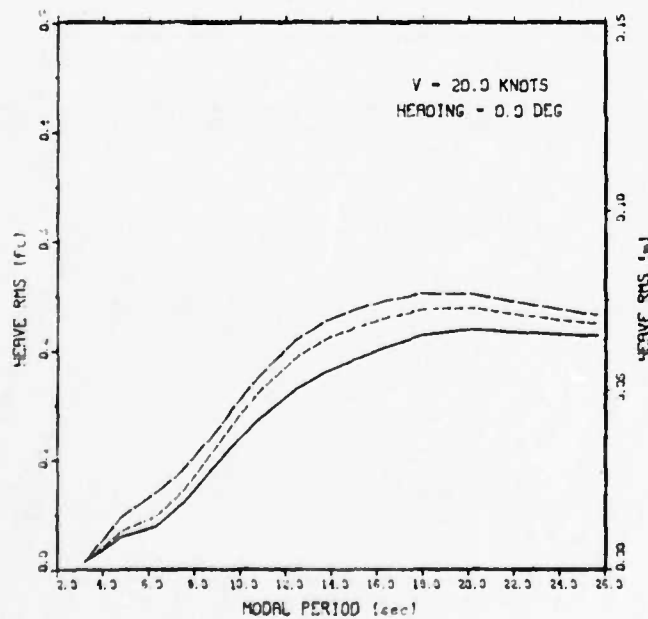
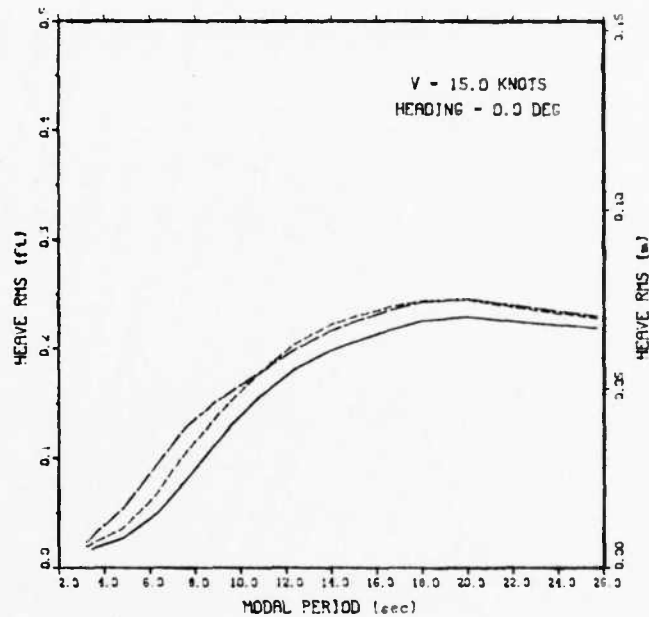
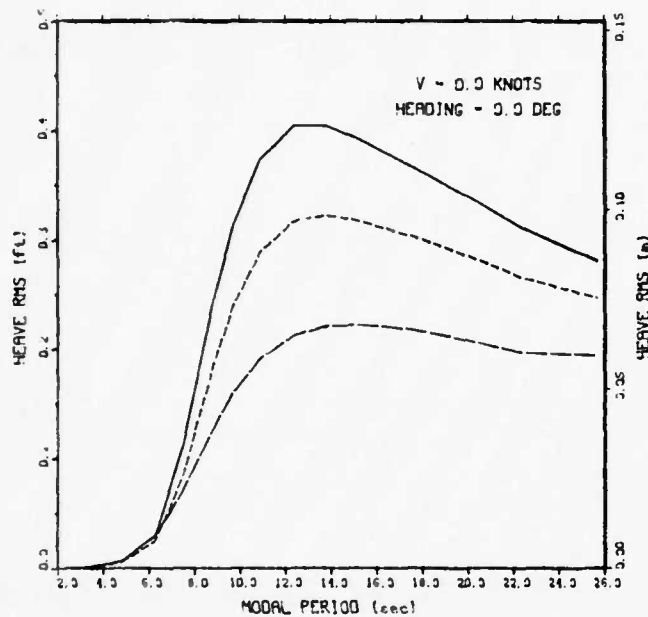


Figure 6s - Responses for Configurations 3111, 3112, and 3113

FIGURE 6 - CONTINUED

3121 —————
 3122 - - - - -
 3123 - - - - -

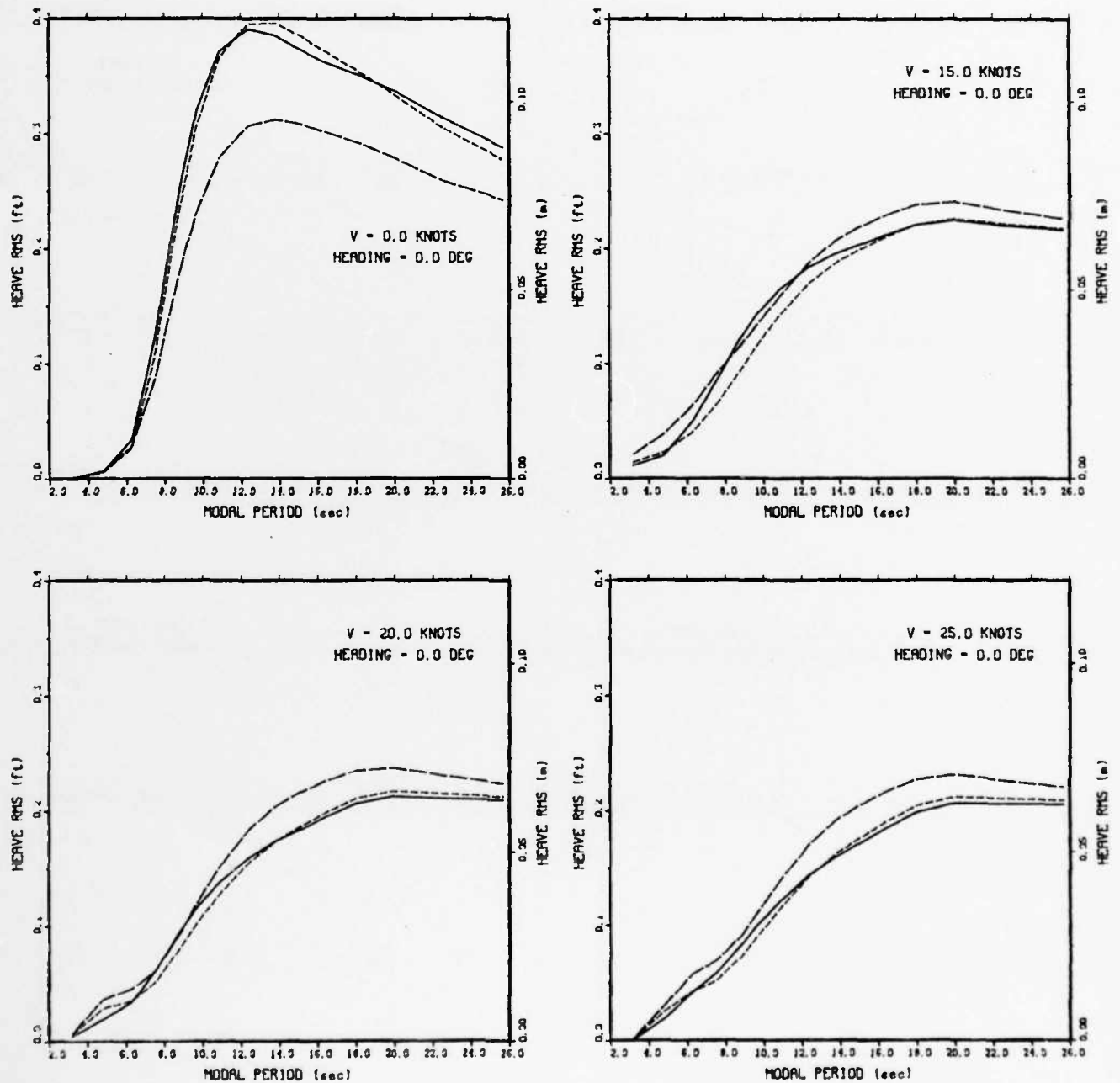


Figure 6t - Responses for Configurations 3121, 3122, and 3123

FIGURE 6 - CONTINUED

3132 - - - - -
3135 - - - - -

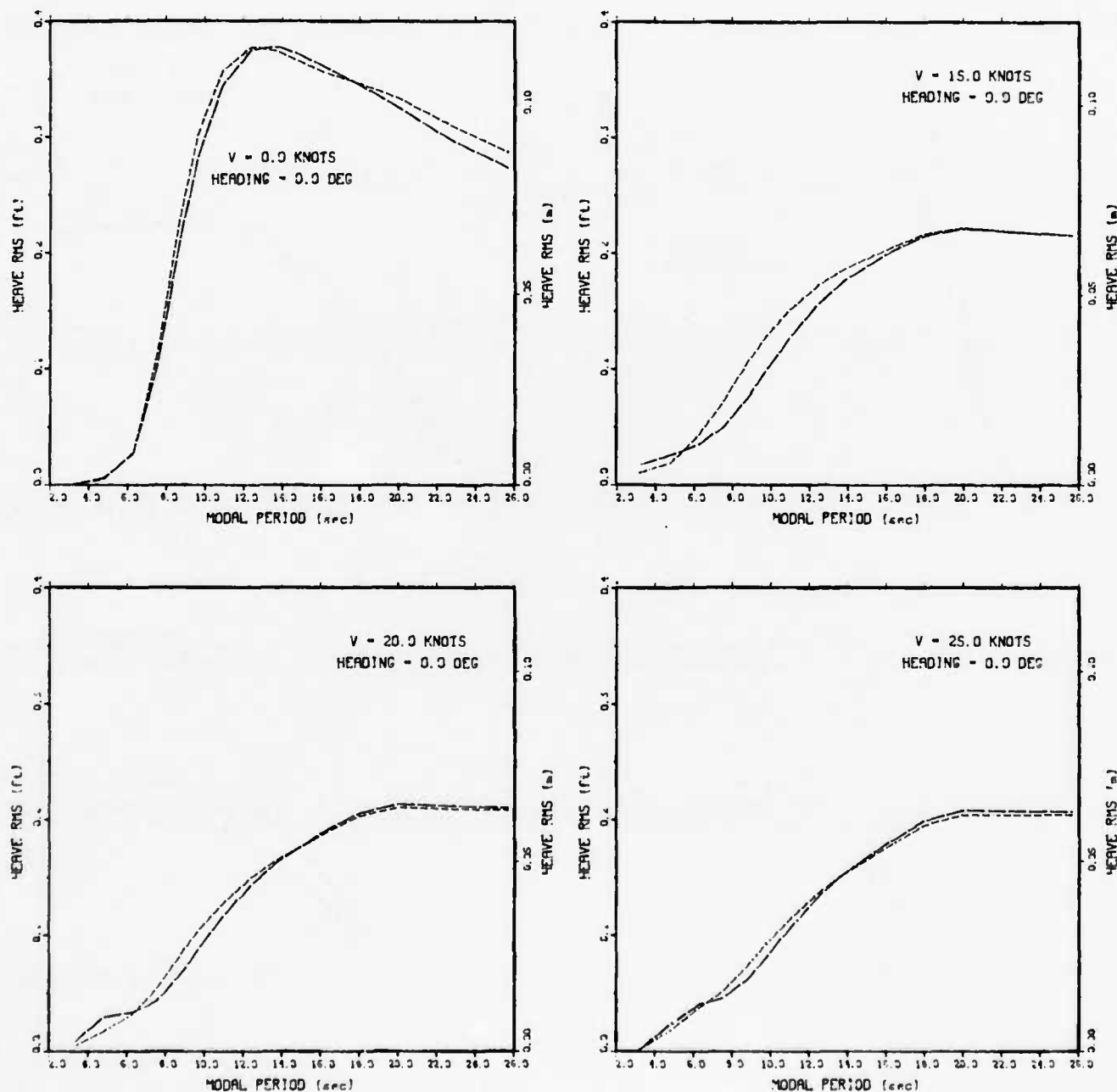


Figure 6u - Responses for Configurations 3132 and 3133

FIGURE 6 - CONTINUED

3211 ———
3212 - - -
3213 - - -

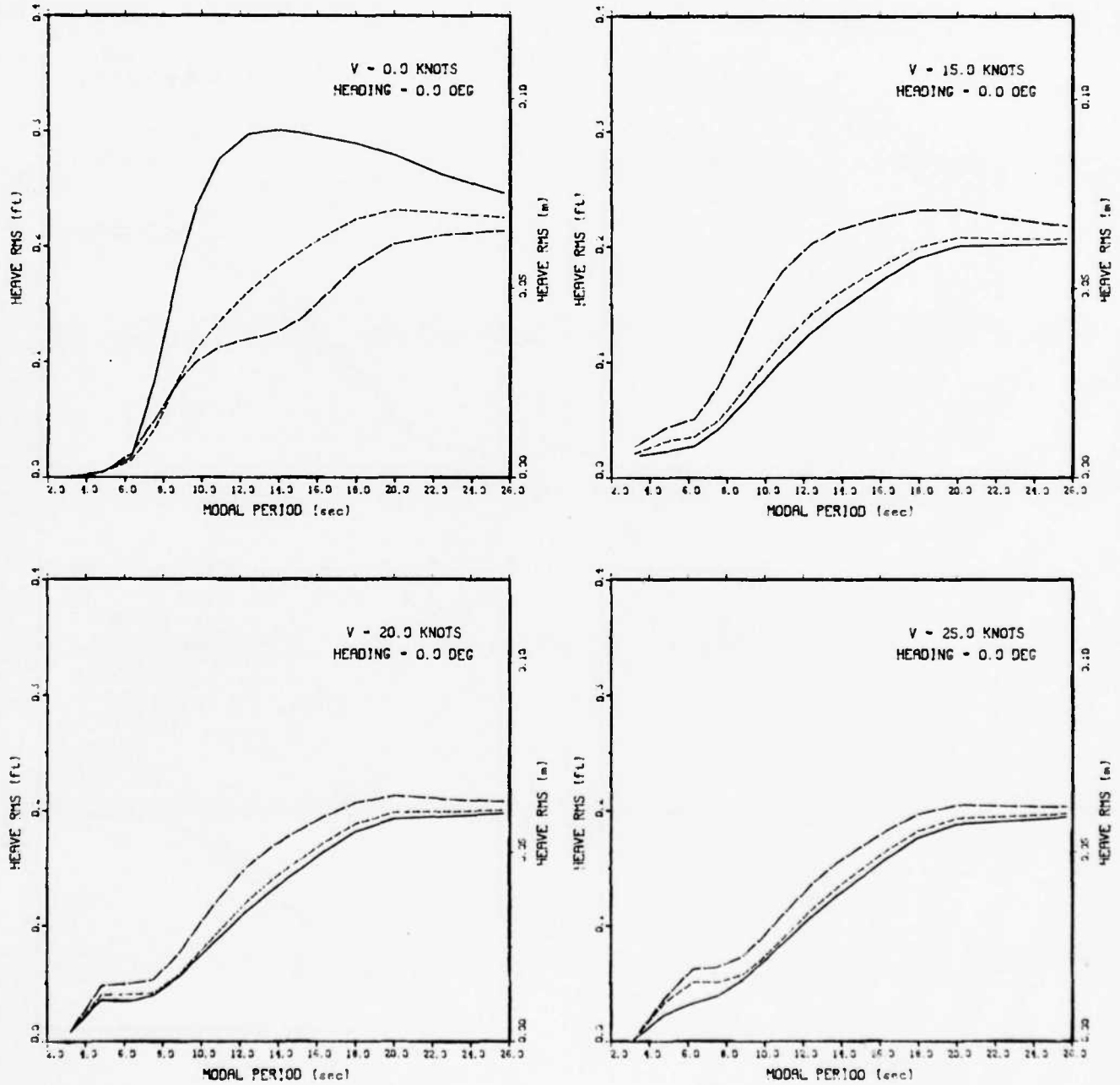


Figure 6v - Responses for Configurations 3211, 3212, and 3213

FIGURE 6 - CONTINUED

3221 ———
3222 - - -
3223 - · -

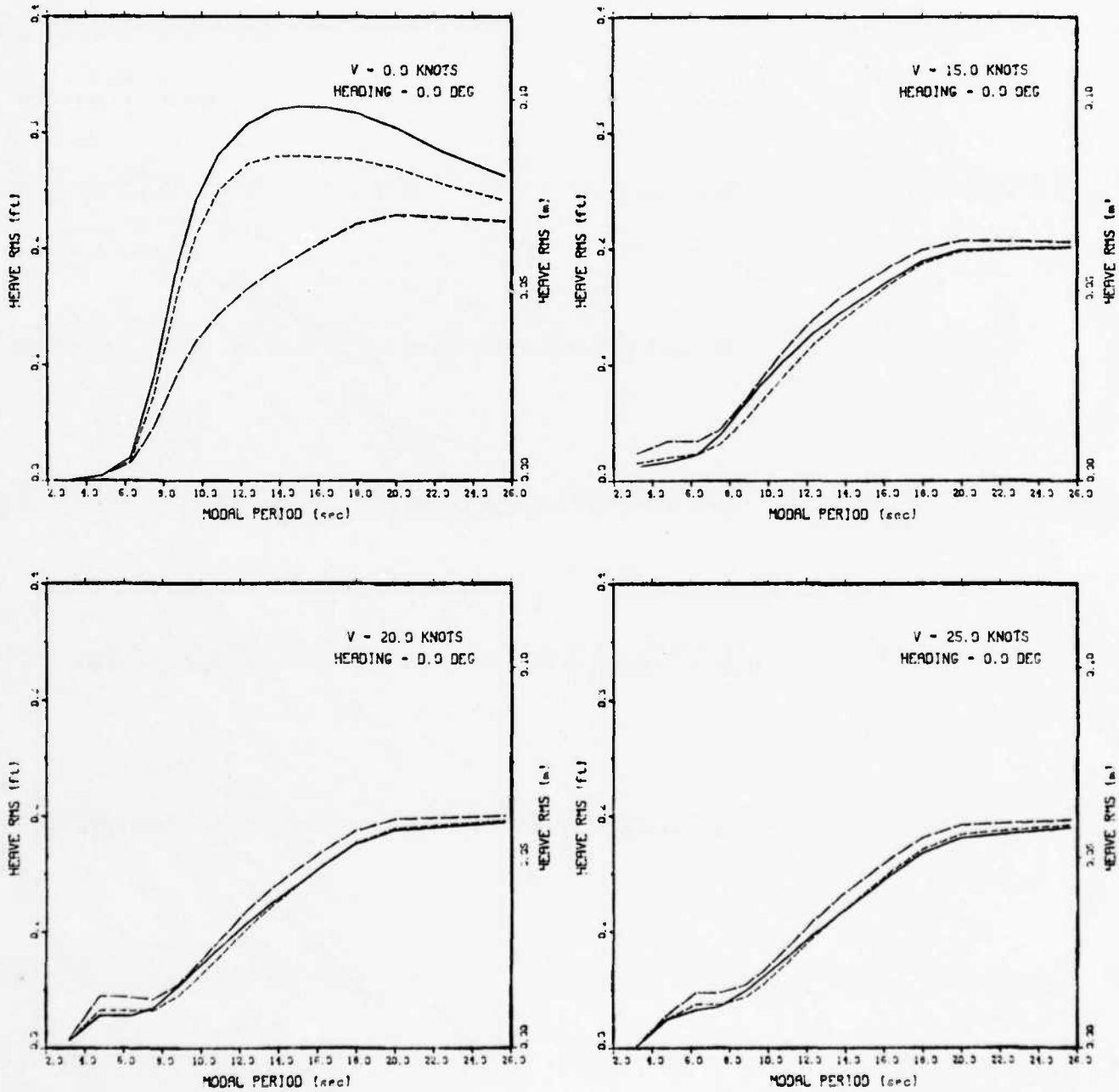


Figure 6w - Responses for Configurations 3221, 3222, and 3223

FIGURE 6 - CONTINUED

3231 ———
3232 - - -
3233 - - -

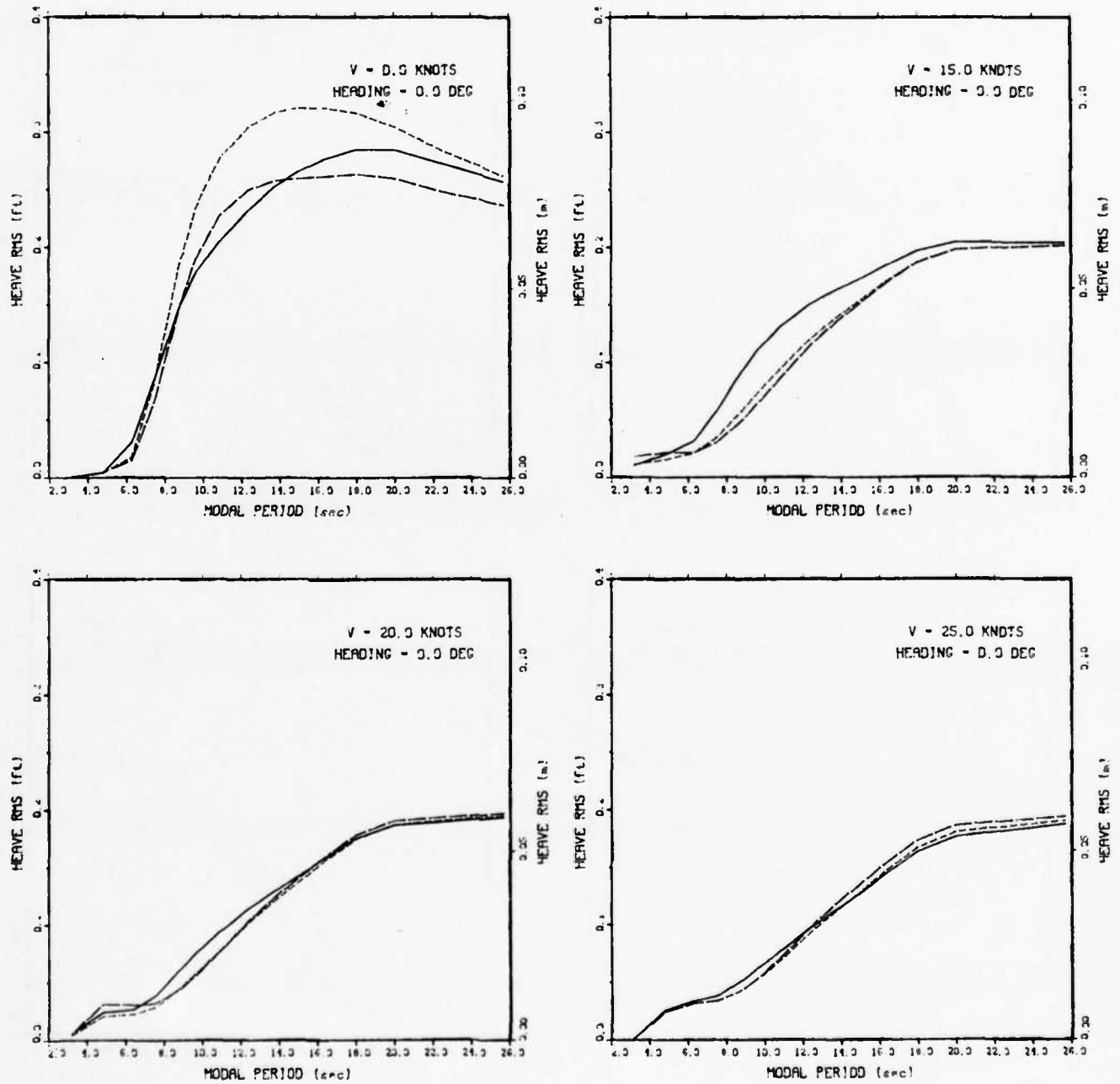


Figure 6x - Responses for Configurations 3231, 3232, and 3233

FIGURE 6 - CONTINUED

3311 ———
3312 - - -
3313 ———

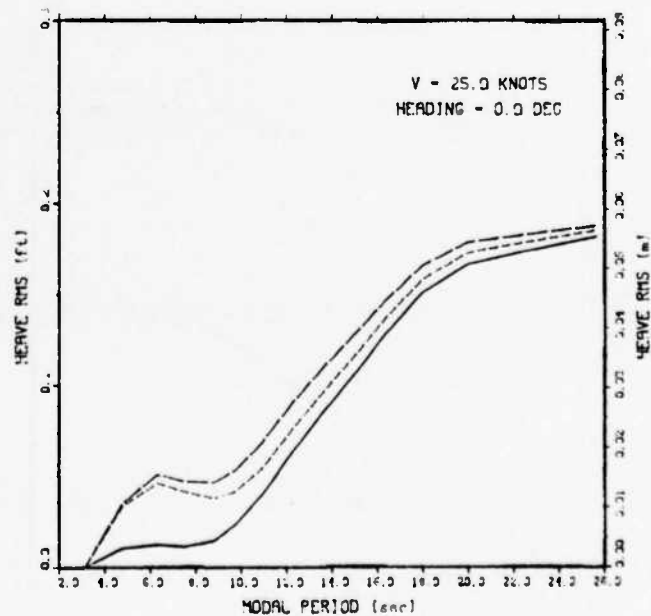
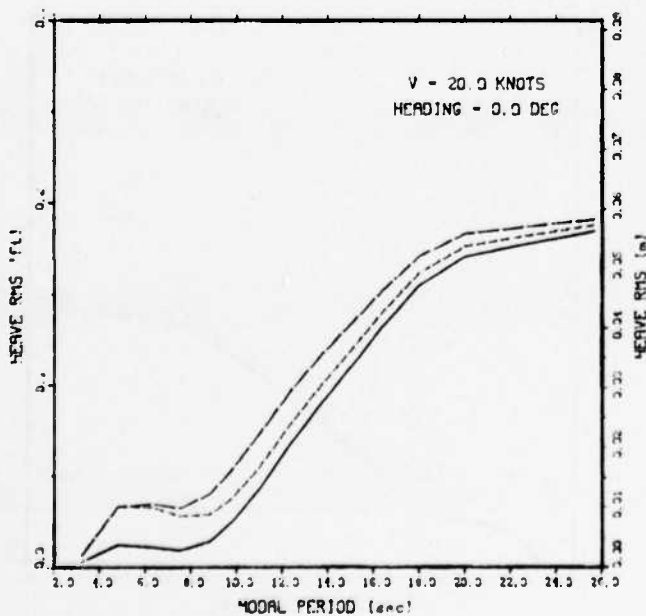
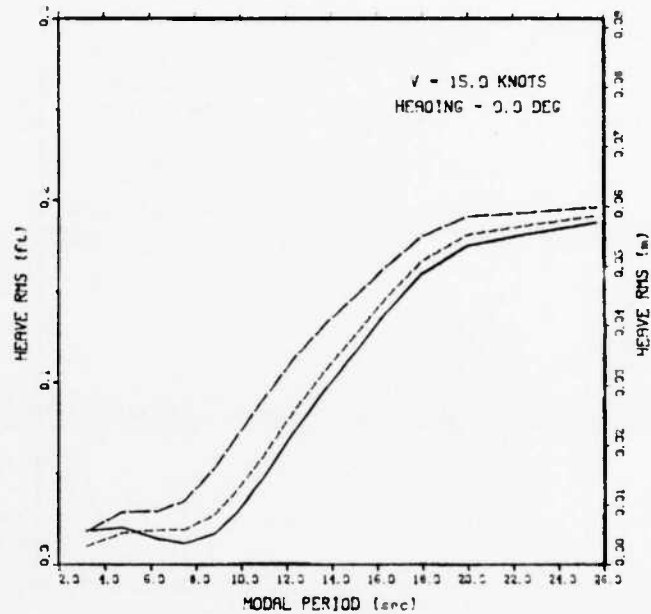
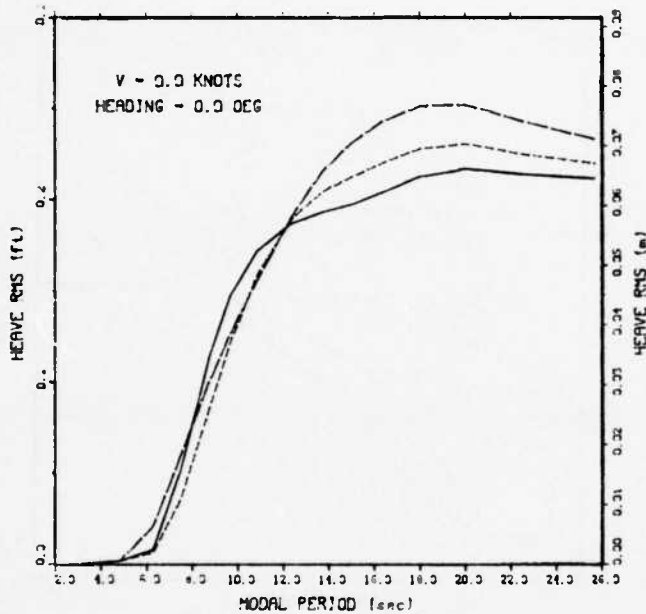


Figure 6y - Responses for Configurations 3311, 3312, and 3313

FIGURE 6 - CONTINUED

3521 ———
3522 - - -
3523 ———

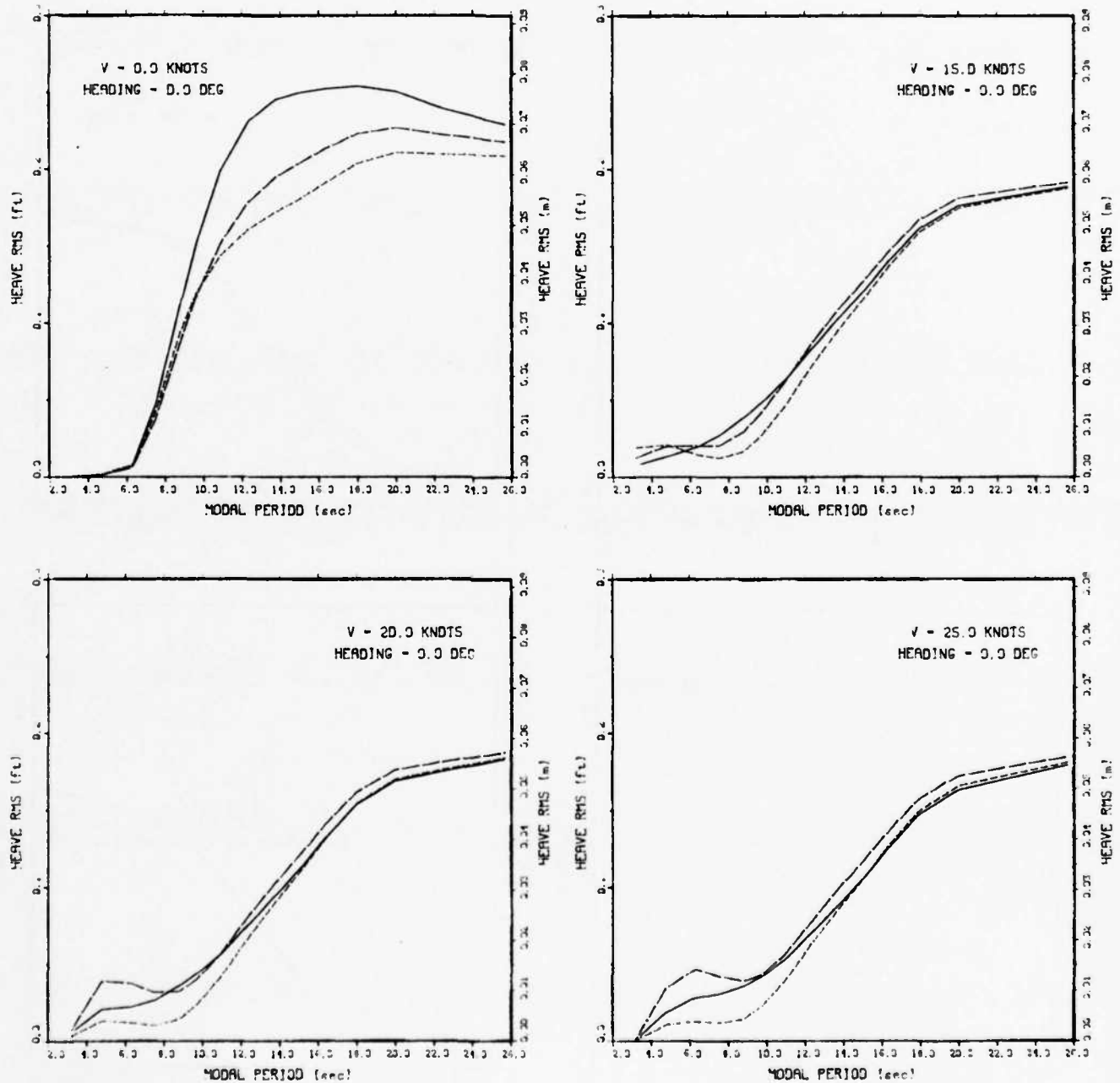


Figure 6z - Responses for Configurations 3321, 3322, and 3323

FIGURE 6 - CONTINUED

3331 —————
 3332 - - - - -
 3333 - - - - -

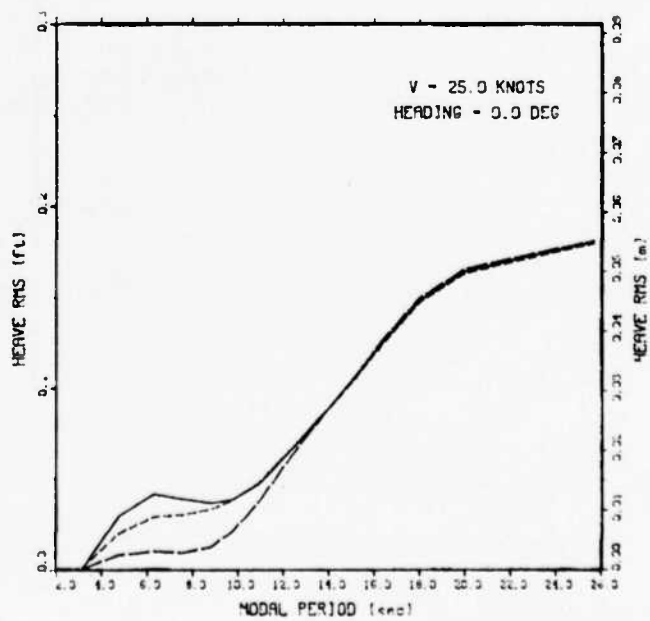
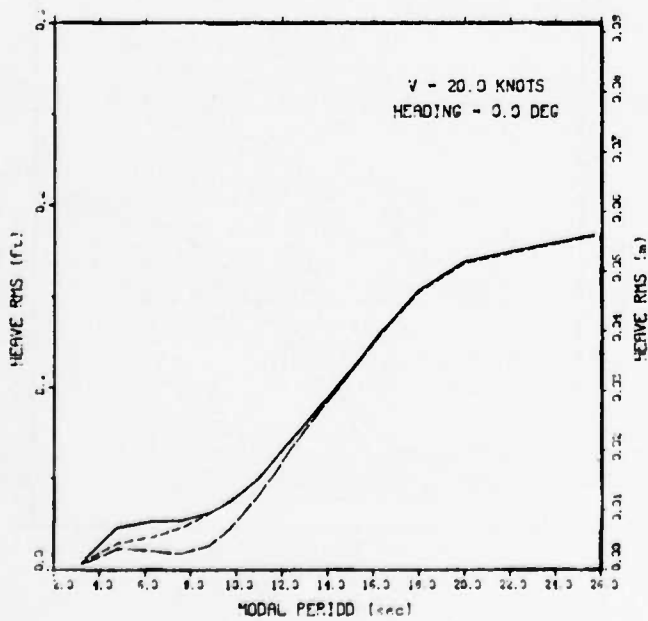
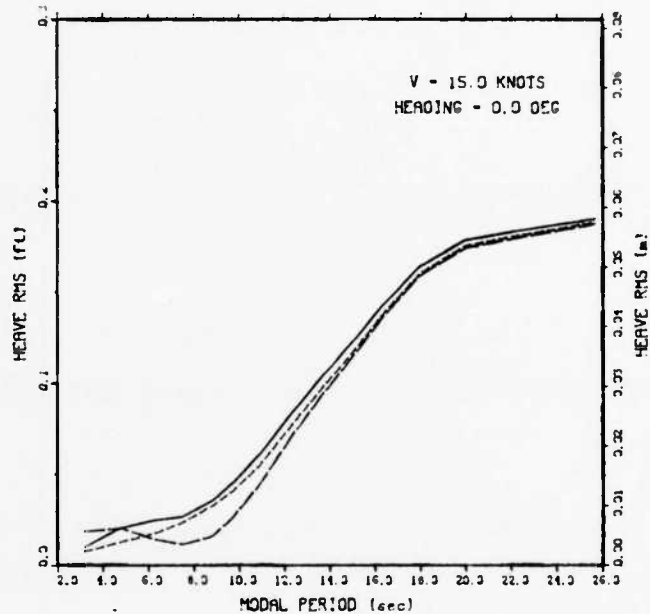
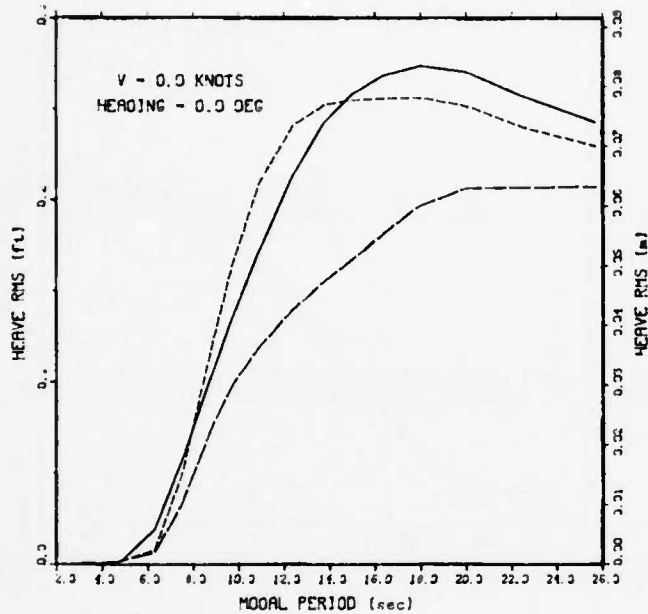


Figure 6aa - Responses for Configurations 3331, 3332, and 3333

FIGURE 7 - PITCH RMS RESPONSES IN FOLLOWING SEAS

1111 —————
 1112 - - - - -
 1113 - · - - -

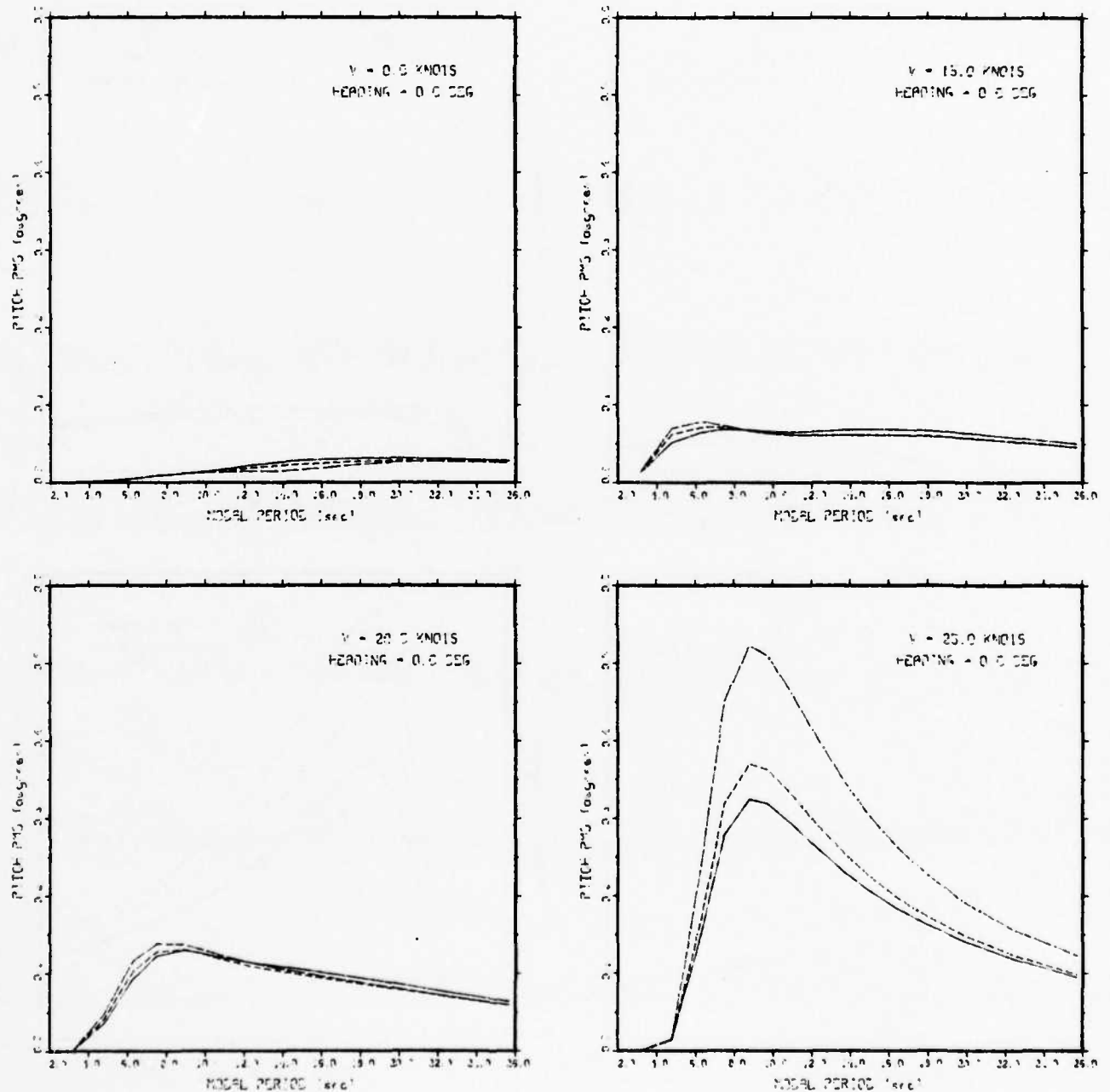


Figure 7a - Responses for Configurations 1111, 1112, and 1113

FIGURE 7 - CONTINUED

1121 —————
 1122 - - - - -
 1123 ······

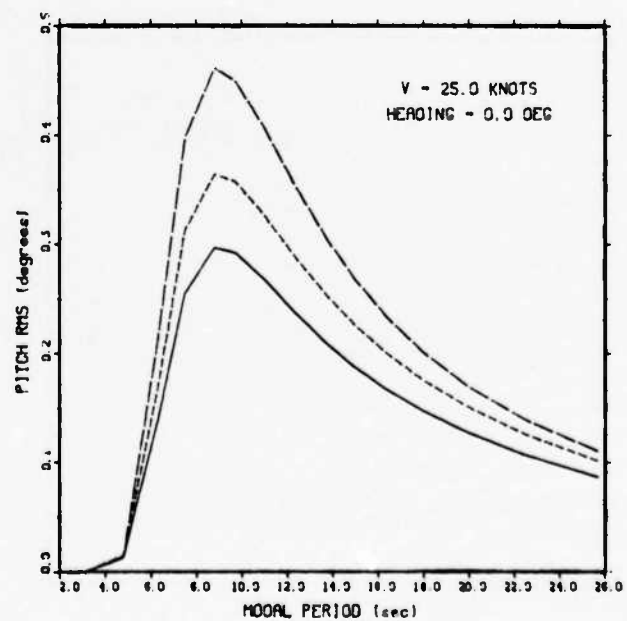
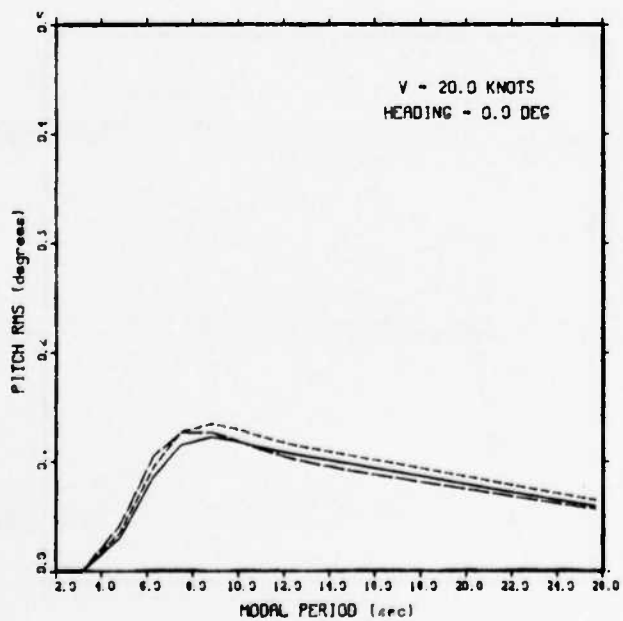
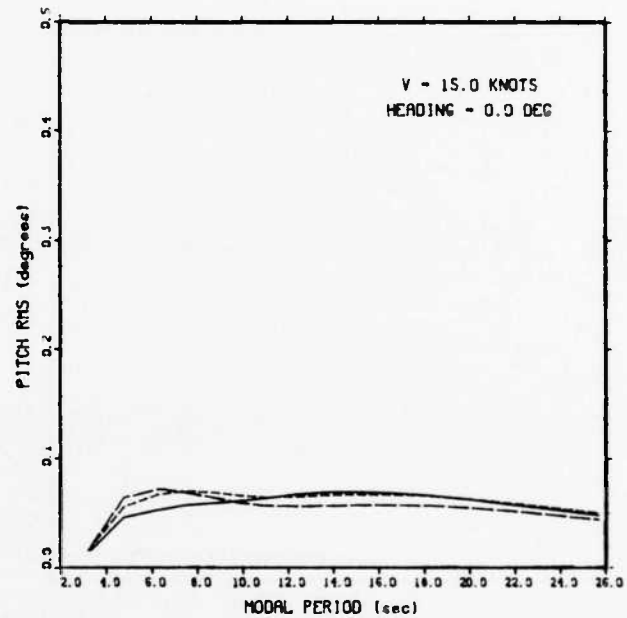
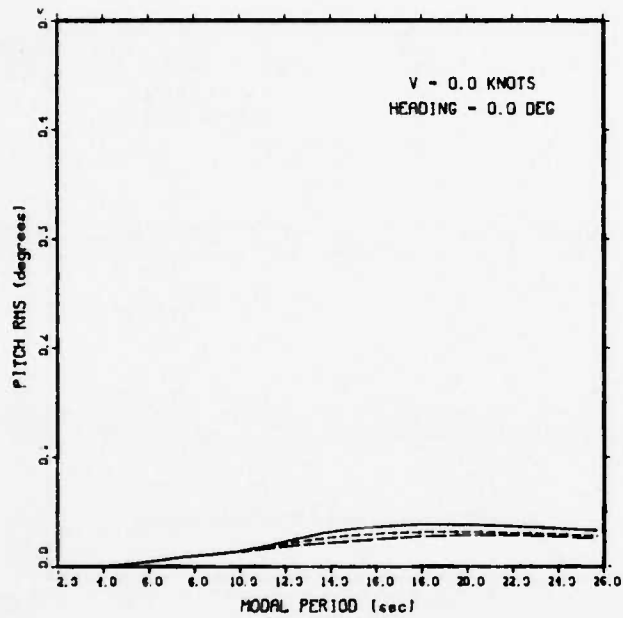


Figure 7b - Responses for Configurations 1121, 1122, and 1123

FIGURE 7 - CONTINUED

1131 —————
 1132 - - - - -
 1133 - - - - -

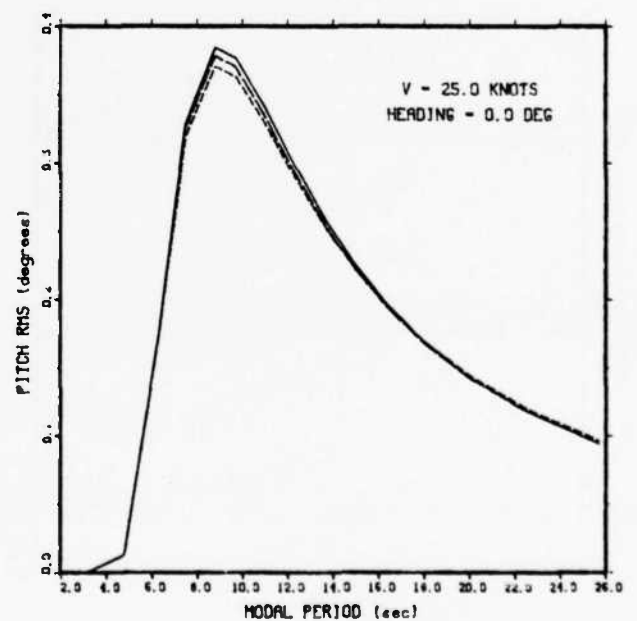
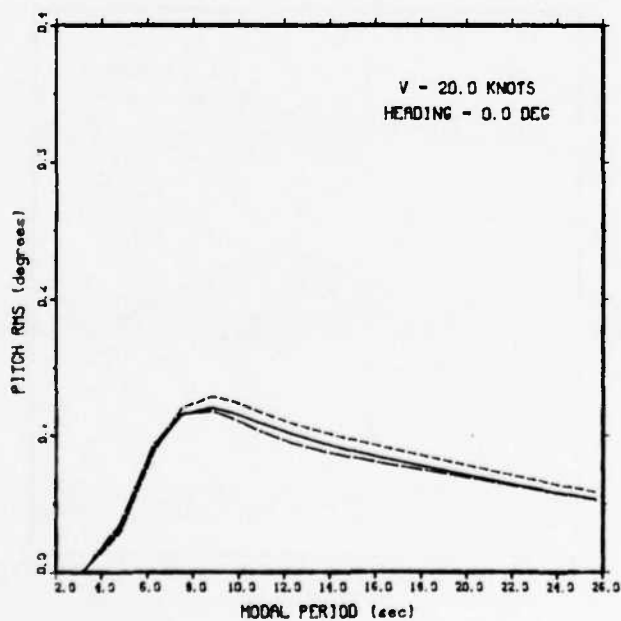
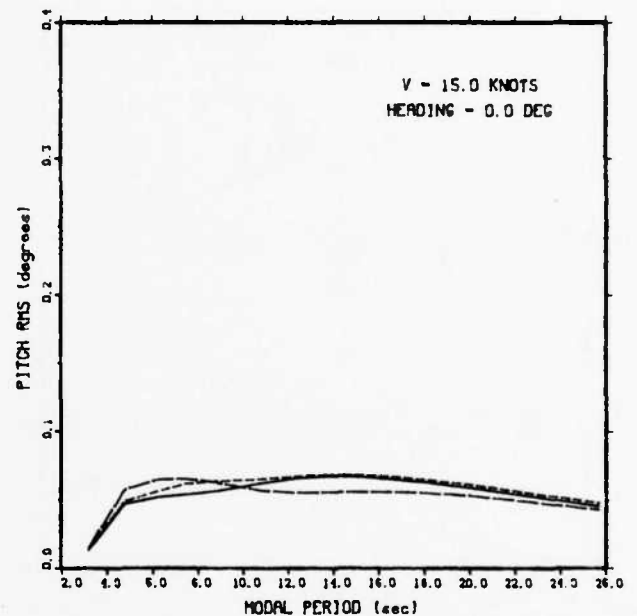
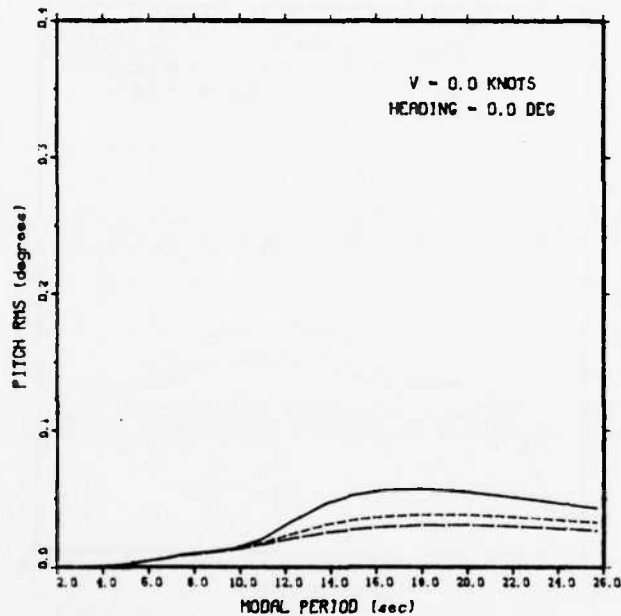


Figure 7c - Responses for Configurations 1131, 1132, and 1133

FIGURE 7 - CONTINUED

1211 —————
 1212 - - - - -
 1213 - · - - -

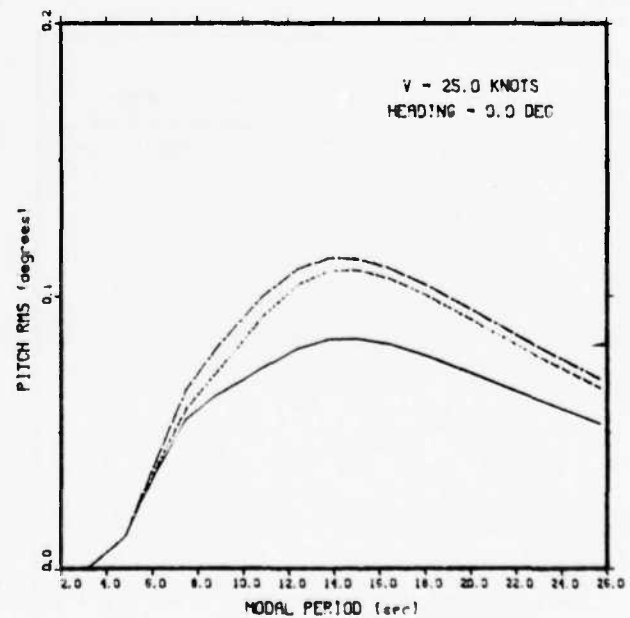
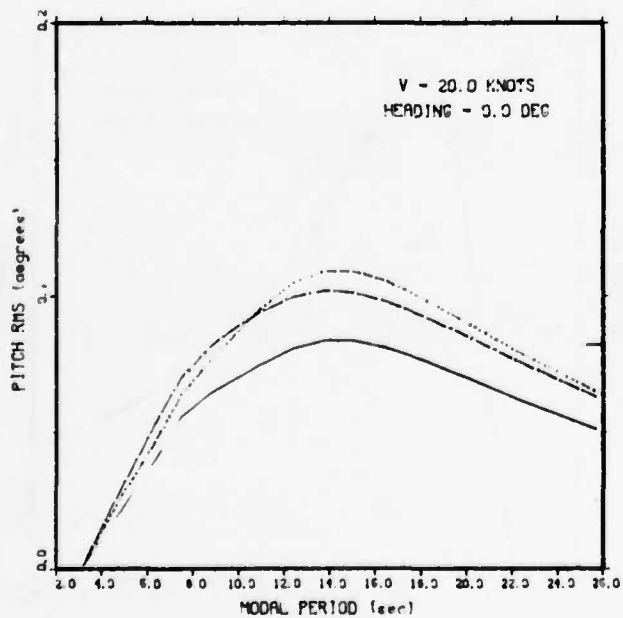
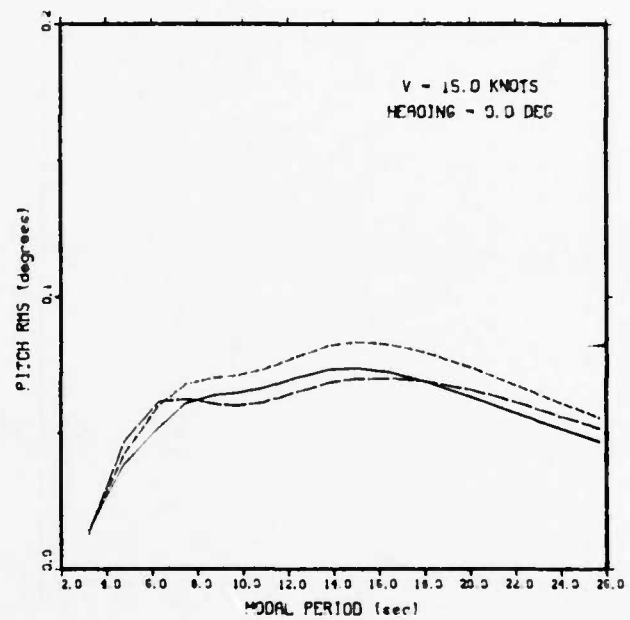
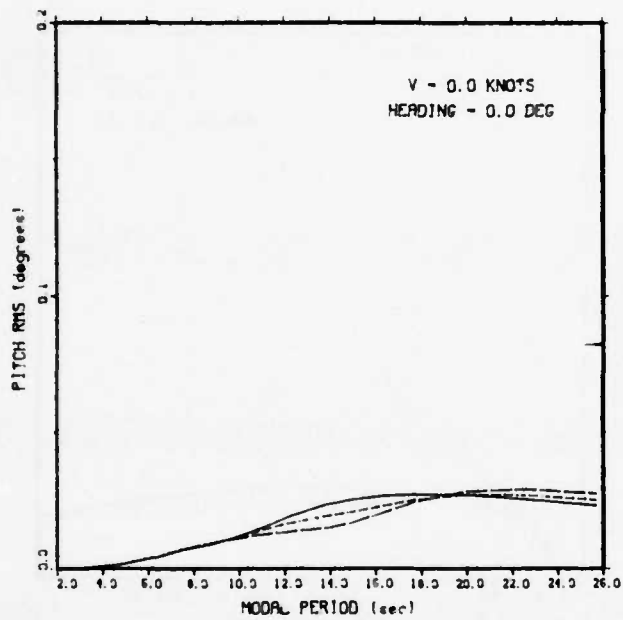


Figure 7d - Responses for Configurations 1211, 1212, and 1213

FIGURE 7 - CONTINUED

1221 —————
 1222 - - - - -
 1223 - - - - -

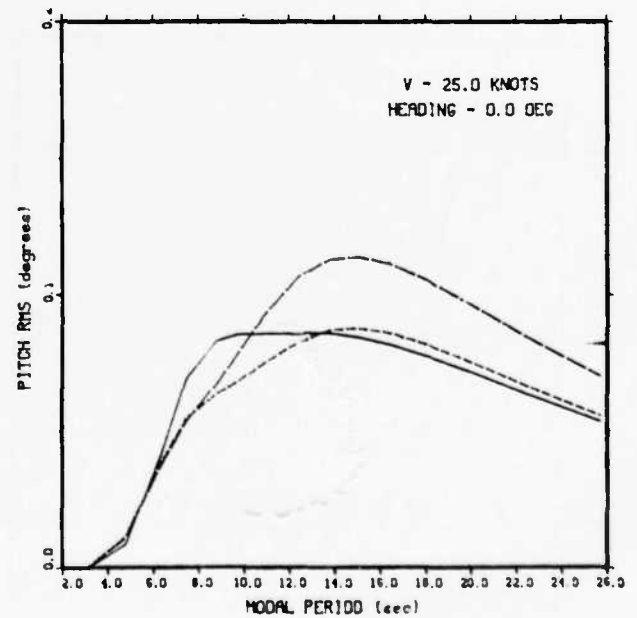
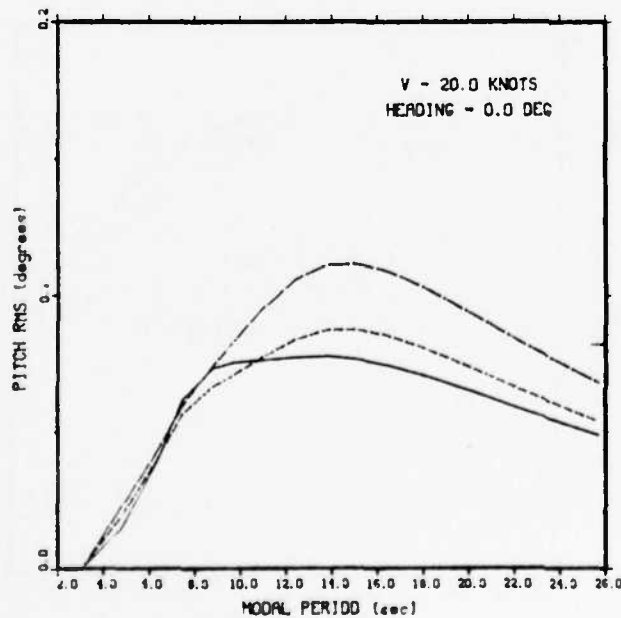
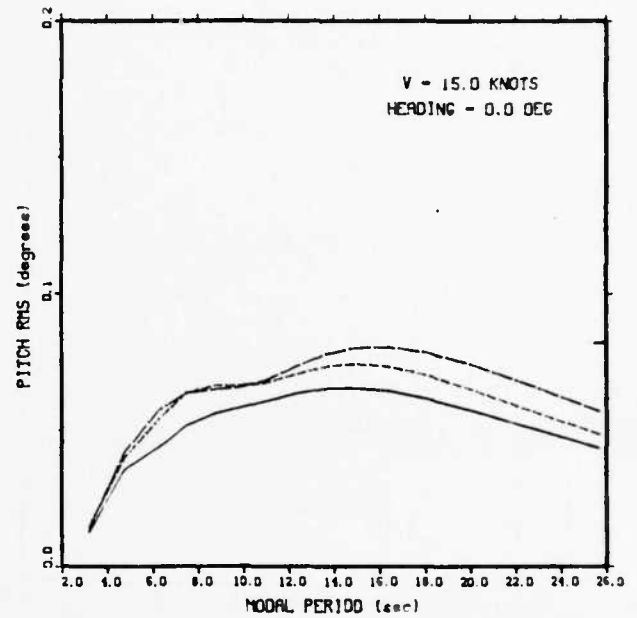
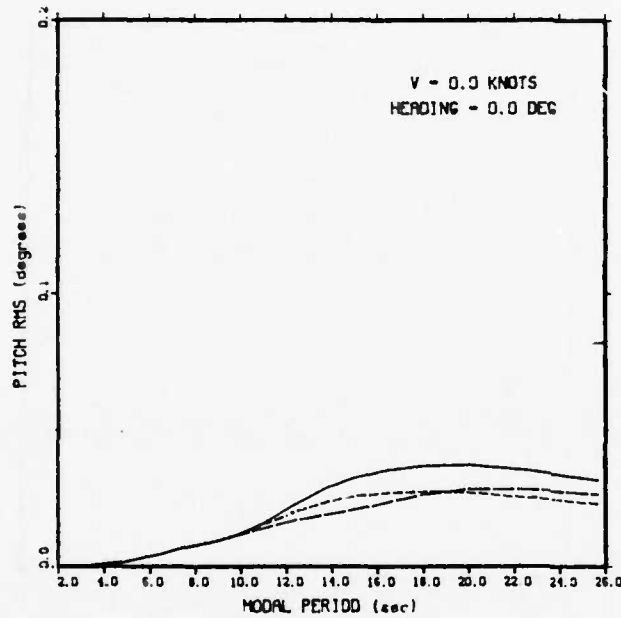


Figure 7e - Responses for Configurations 1221, 1222, and 1223

FIGURE 7 - CONTINUED

1231 —————
 1232 - - - - -
 1233 - - - - -

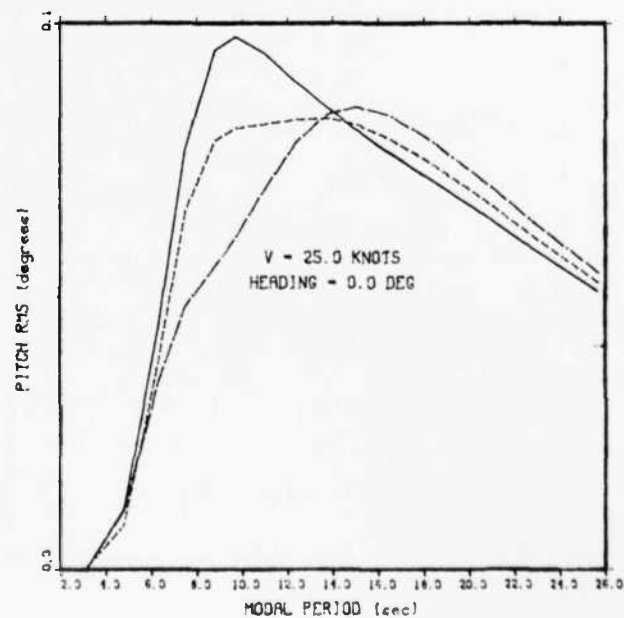
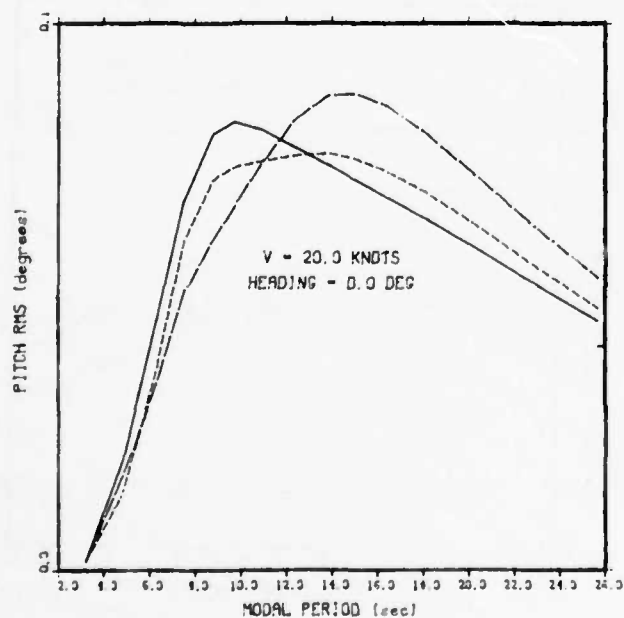
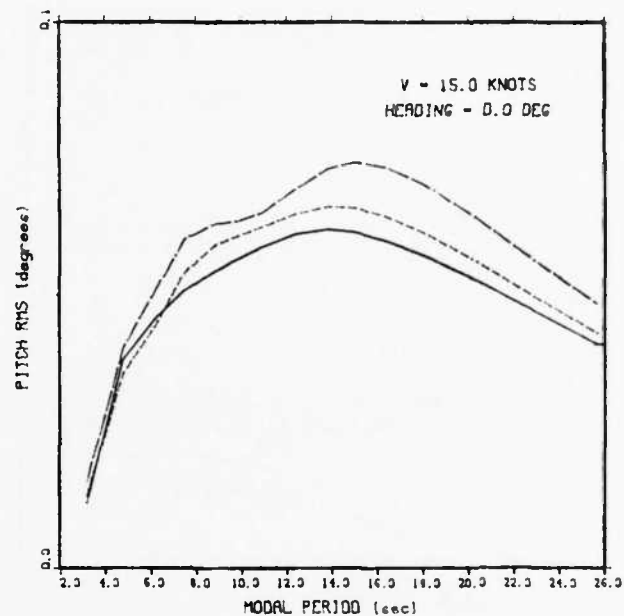
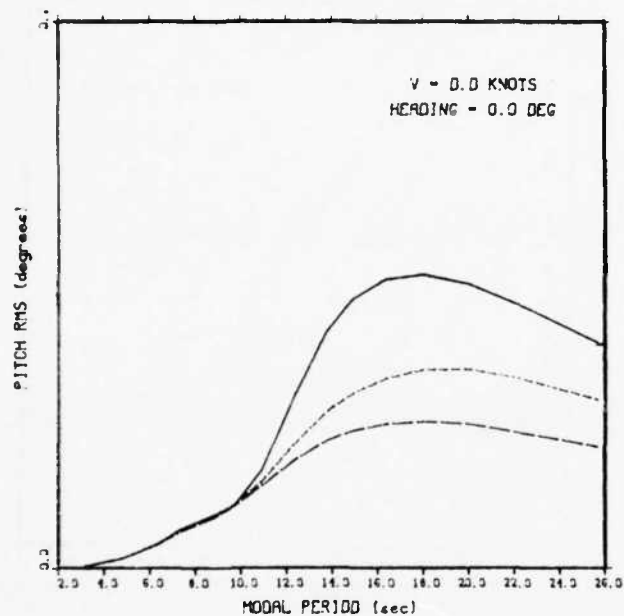


Figure 7f - Responses for Configurations 1231, 1232, and 1233

FIGURE 7 - CONTINUED

1311 —————
 1312 - - - - -
 1313 - - - - -

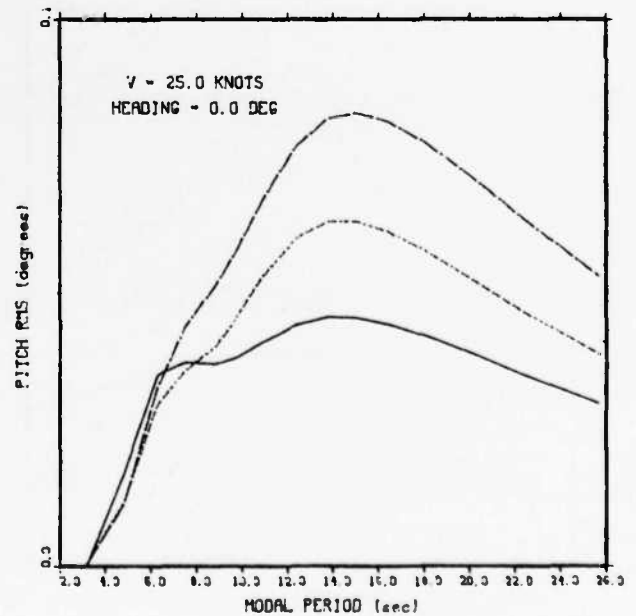
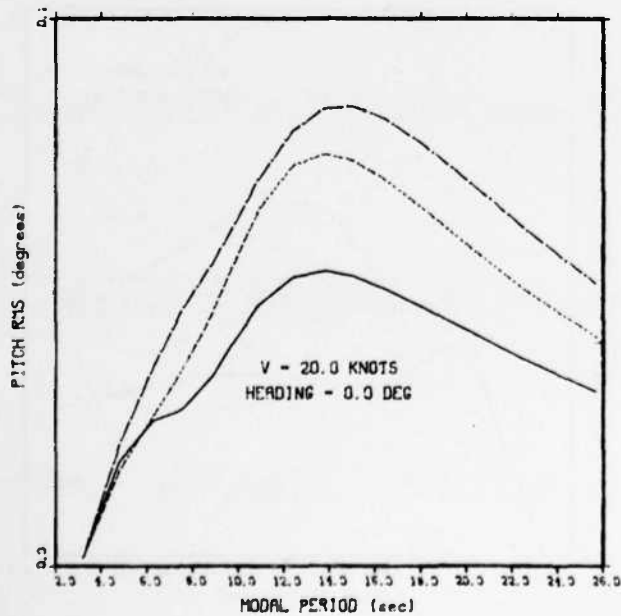
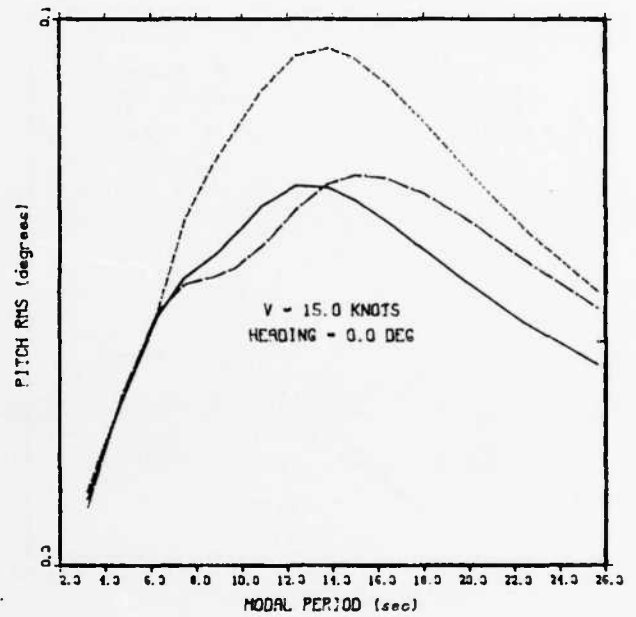
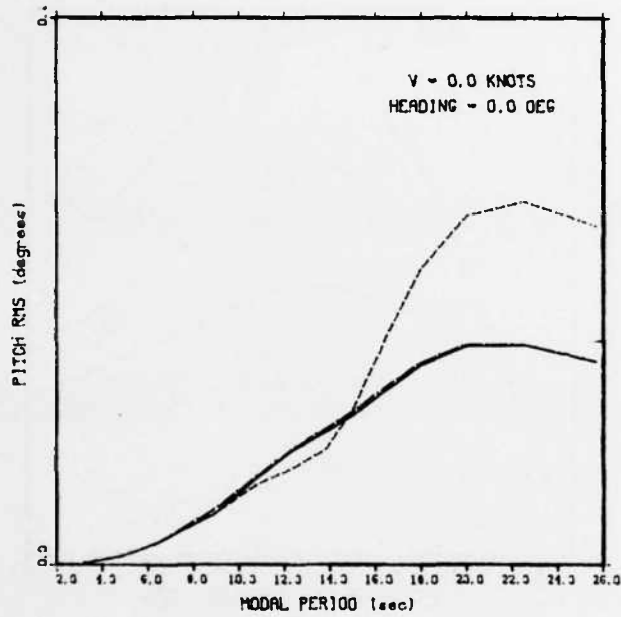


Figure 7g - Responses for Configurations 1311, 1312, and 1313

FIGURE 7 - CONTINUED

1321 —————
 1322 - - - - -
 1323 — · — · —

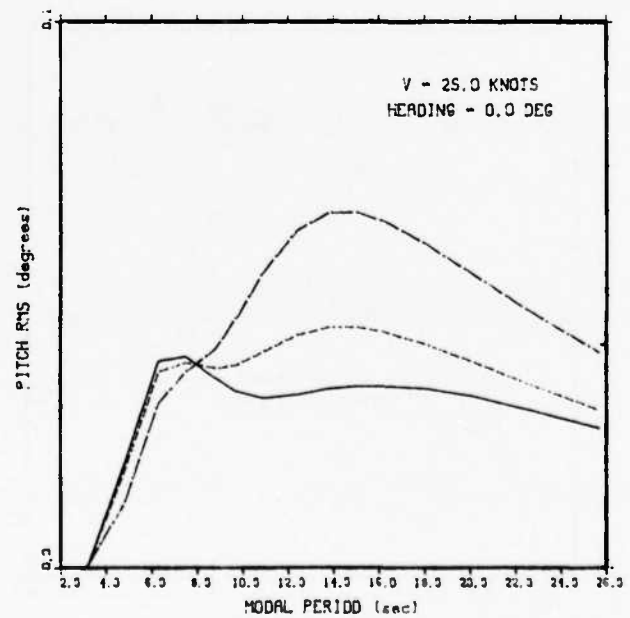
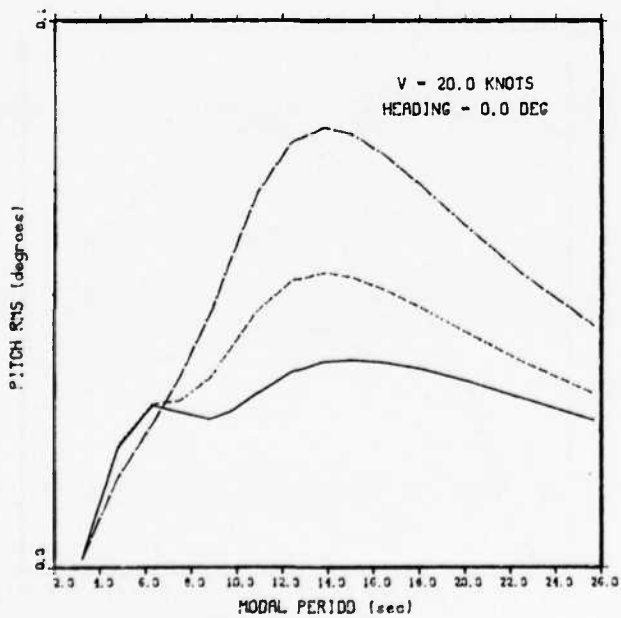
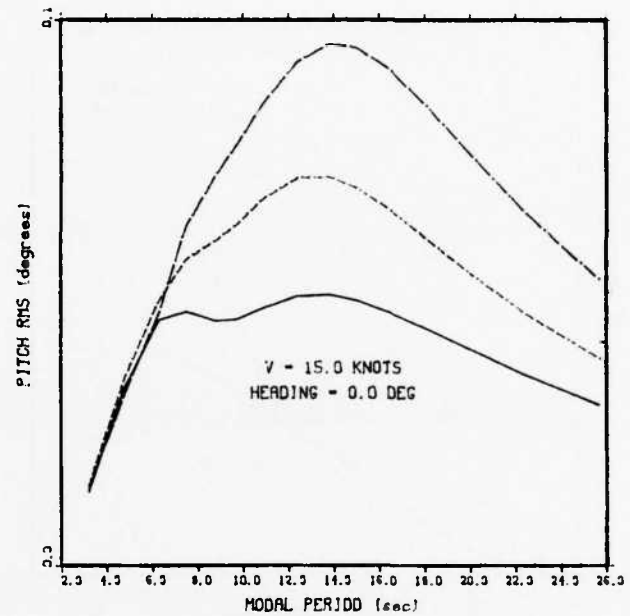
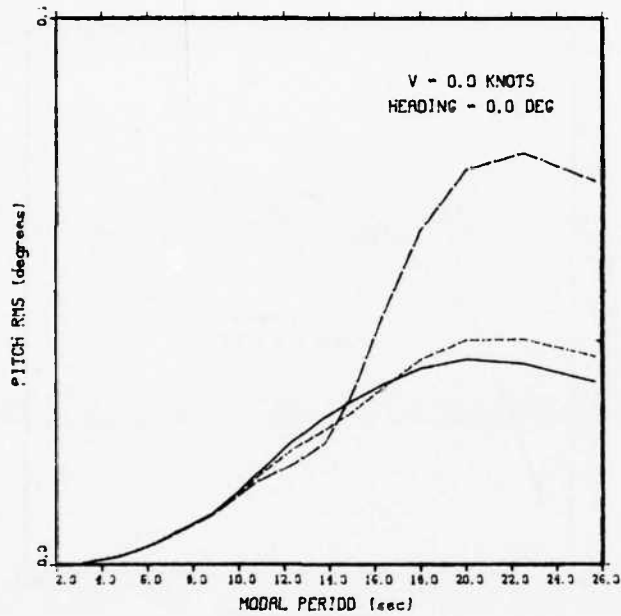


Figure 7h - Responses for Configurations 1321, 1322, and 1323

FIGURE 7 - CONTINUED

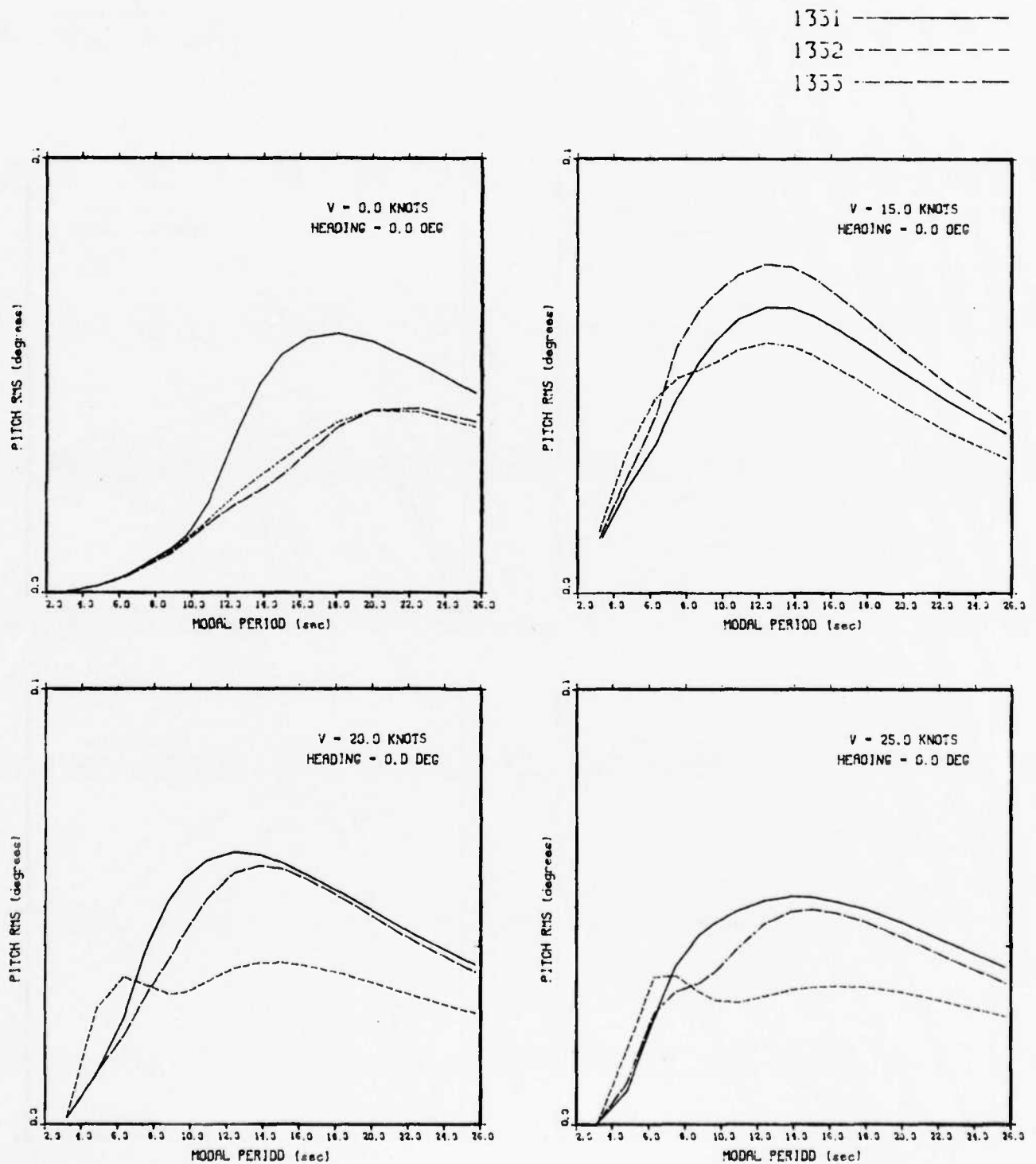


Figure 7i - Responses for Configurations 1331, 1332, and 1333

FIGURE 7 - CONTINUED

2111 —————
 2112 - - - - -
 2113 - - - - -

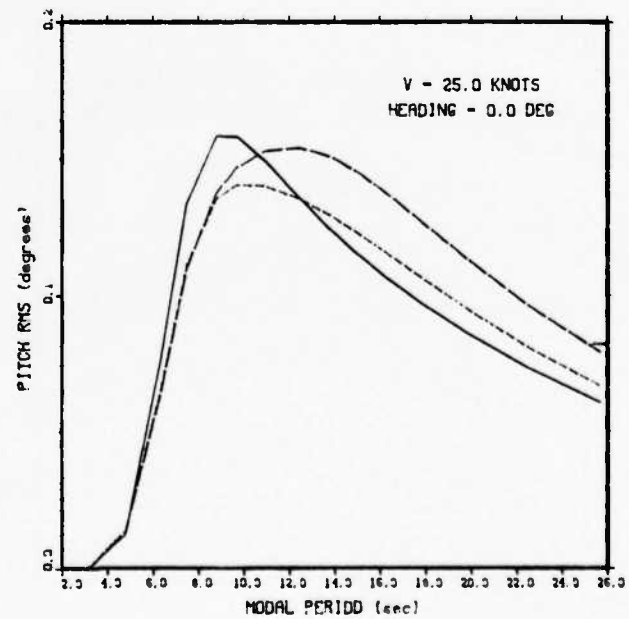
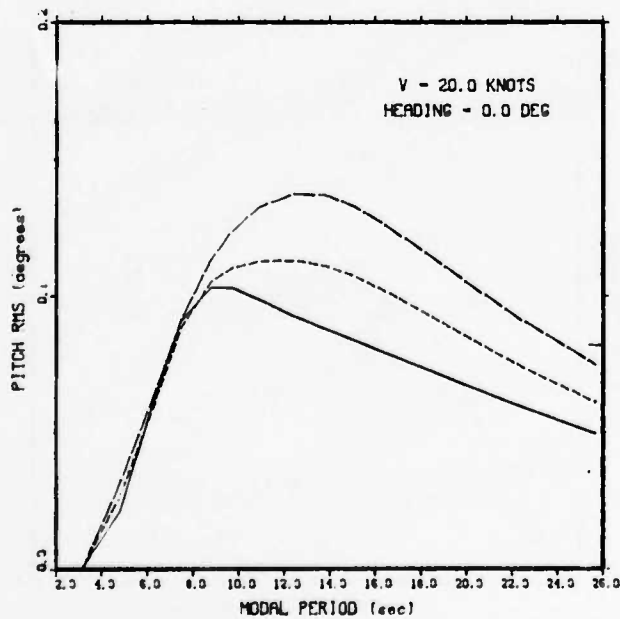
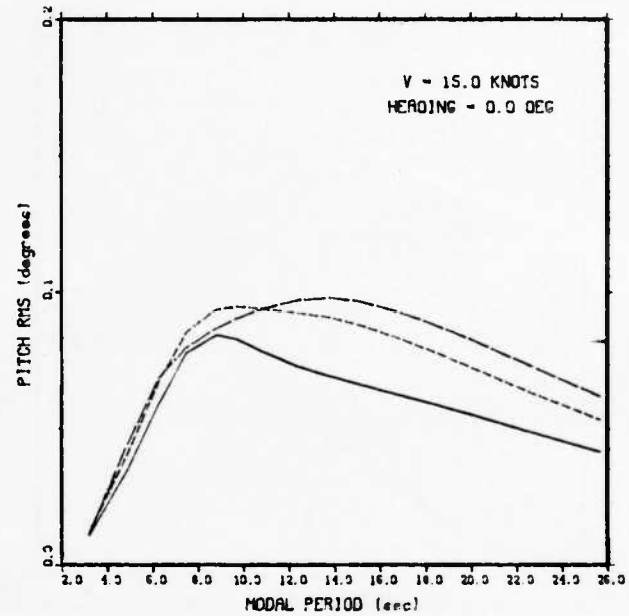
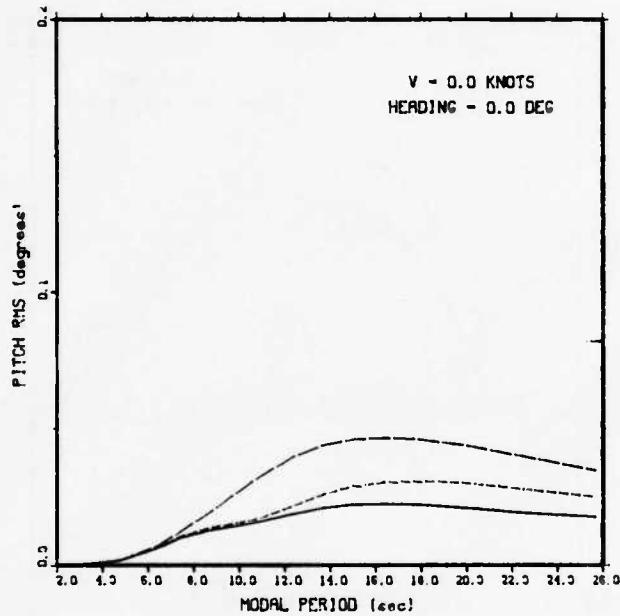


Figure 7j - Responses for Configurations 2111, 2112, and 2113

FIGURE 7 - CONTINUED

2121 —————
 2122 - - - - -
 2123 - · - - · -

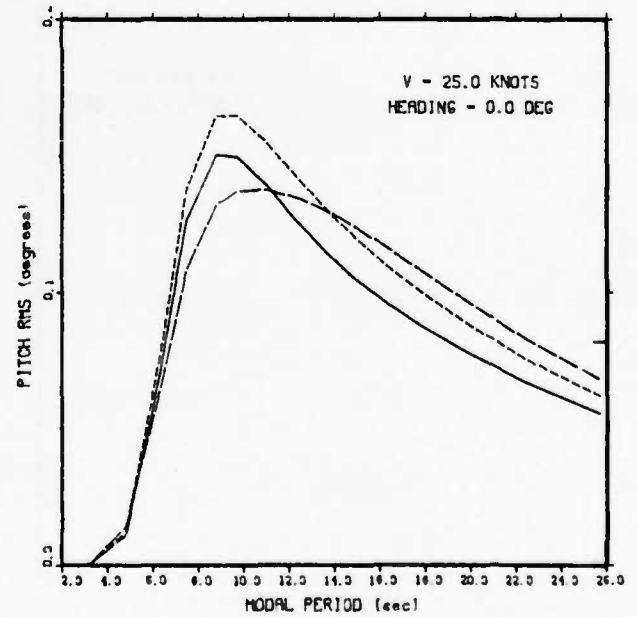
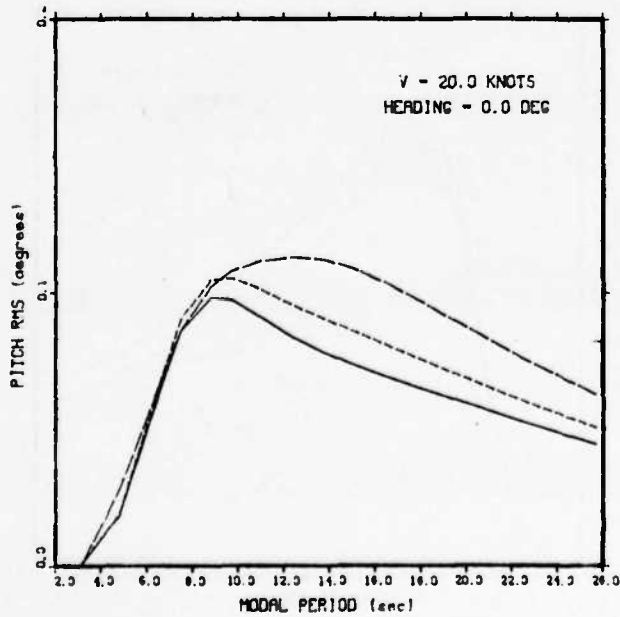
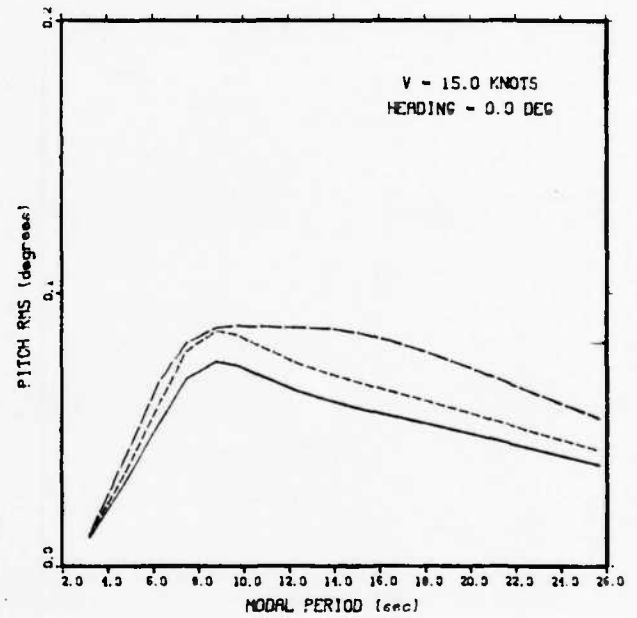
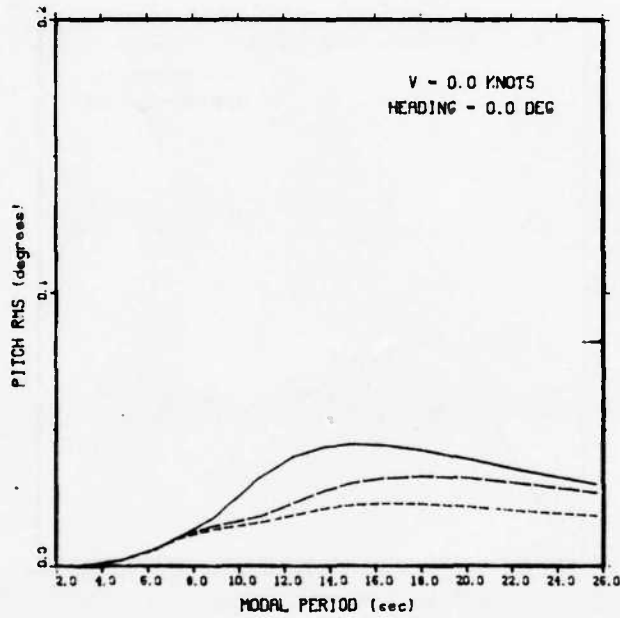


Figure 7k - Responses for Configurations 2121, 2122, and 2123

FIGURE 7 - CONTINUED

2132 - - - - -
2133 - - - - -

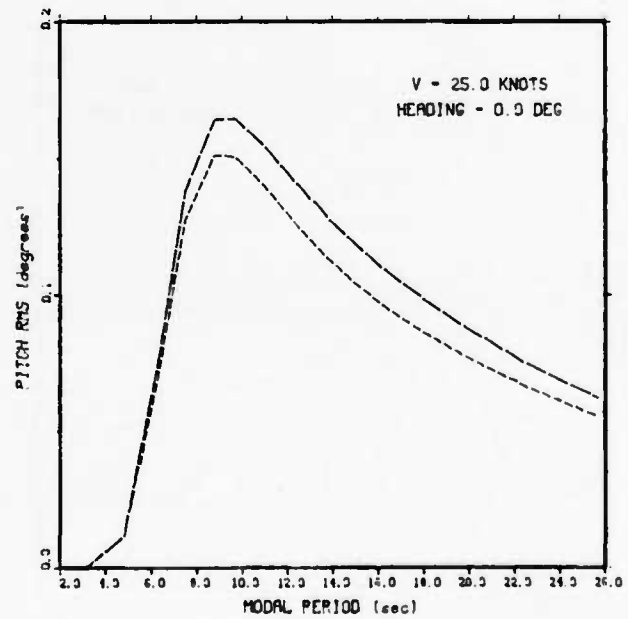
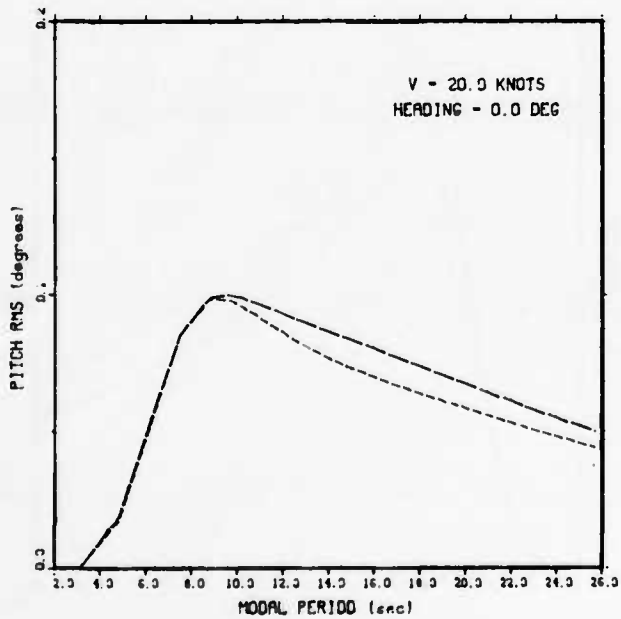
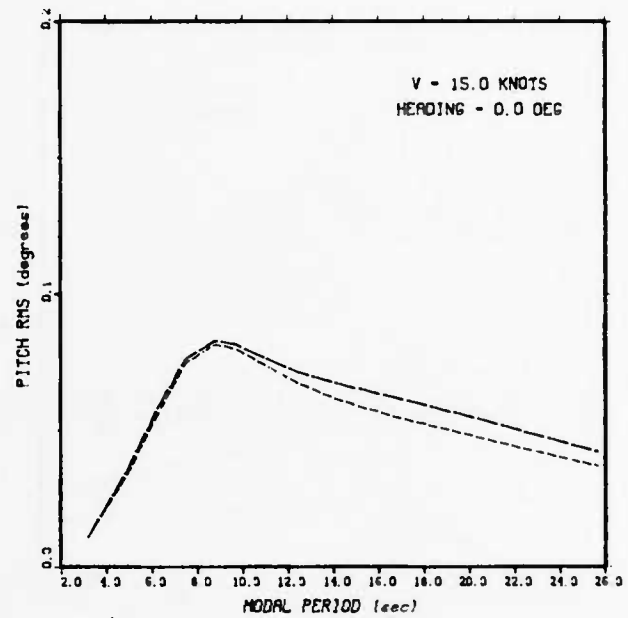
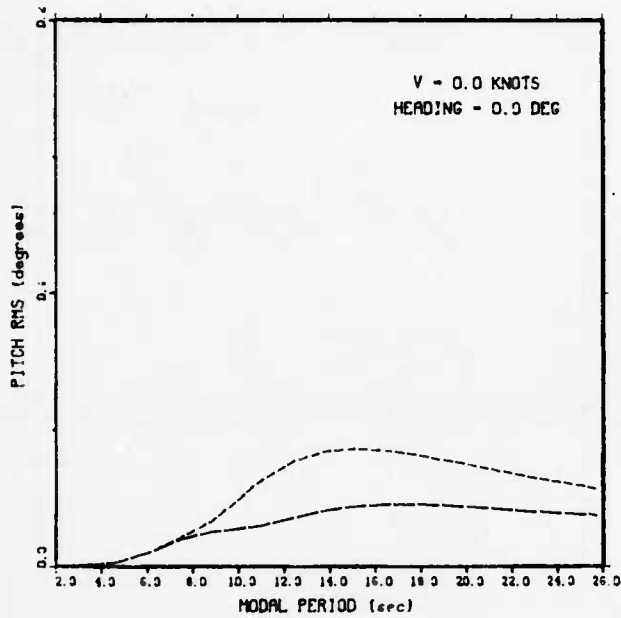


Figure 71 - Responses for Configurations 2132 and 2133

FIGURE 7 - CONTINUED

2211 —————
 2212 - - - - -
 2213 - - - - -

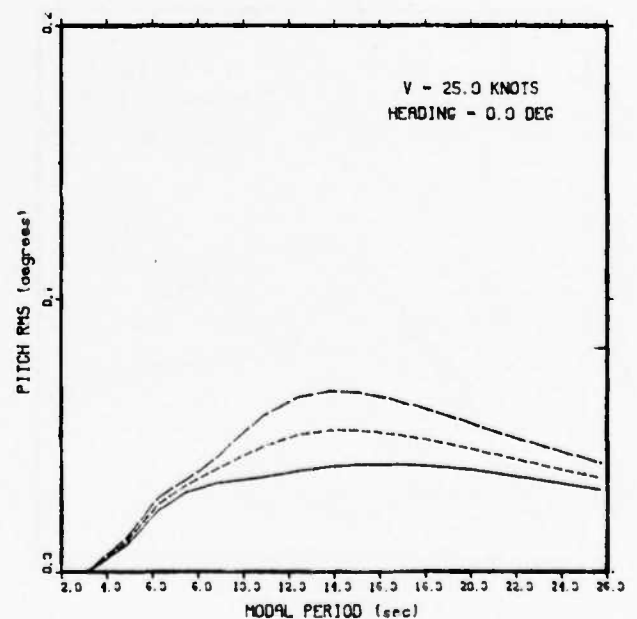
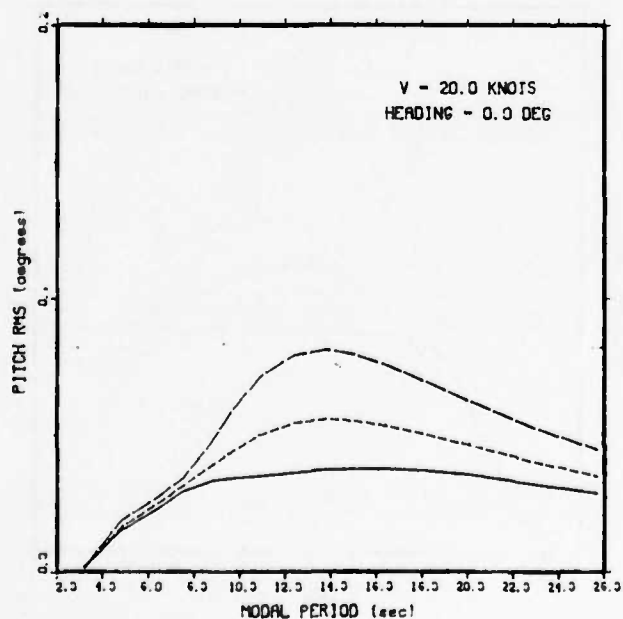
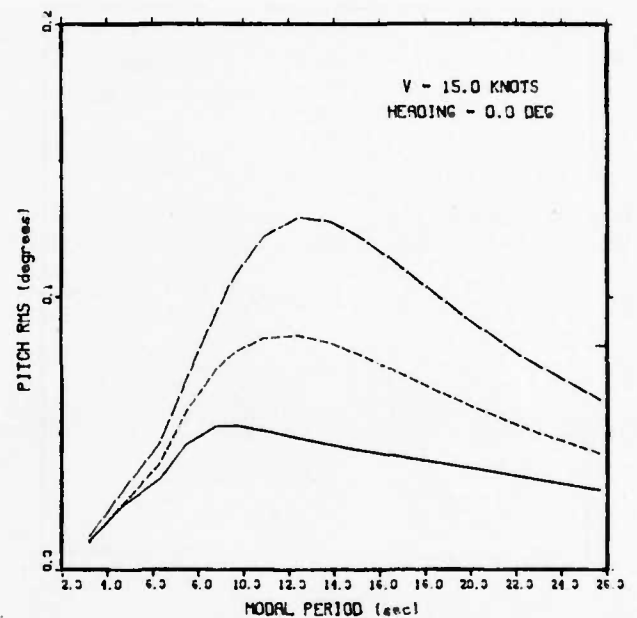
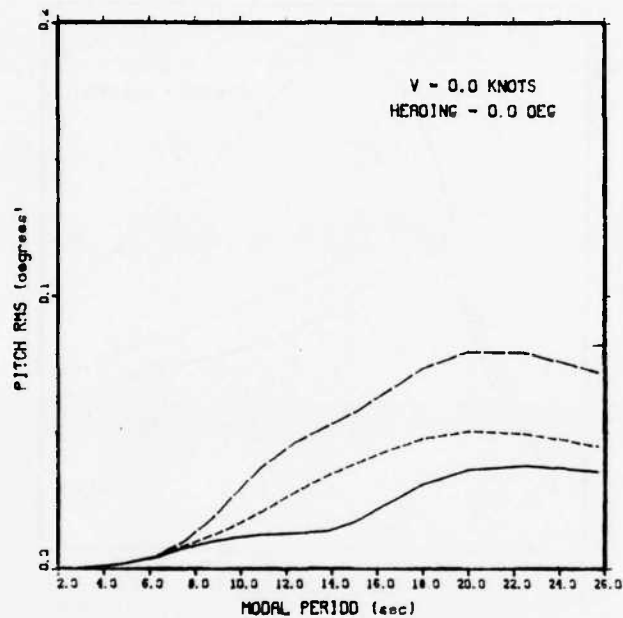


Figure 7m - Responses for Configurations 2211, 2212, and 2213

FIGURE 7 - CONTINUED

2221 —————
 2222 - - - - -
 2223 - - - - -

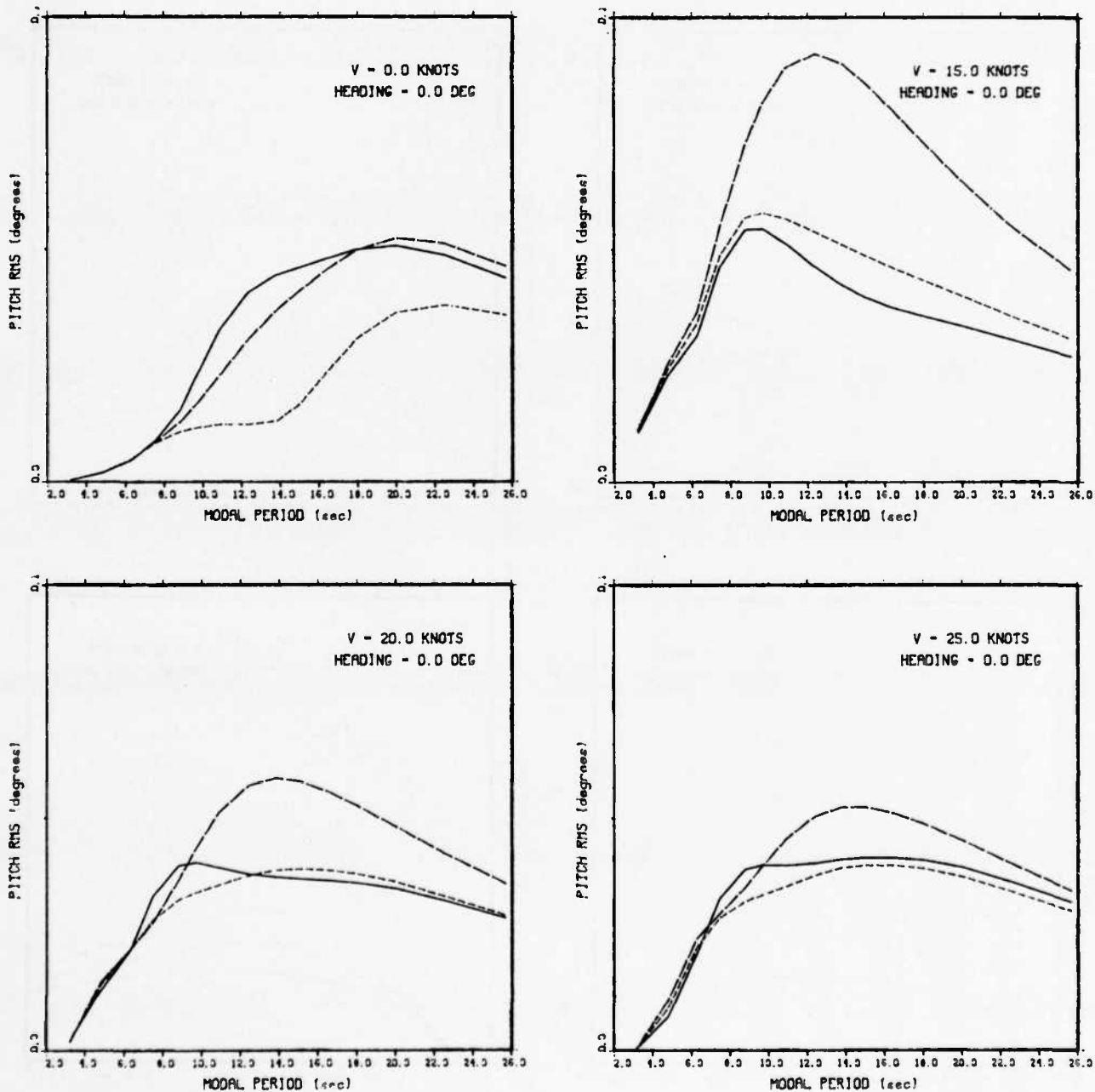


Figure 7n - Responses for Configurations 2221, 2222, and 2223

FIGURE 7 - CONTINUED

2231 ———
 2232 - - - -
 2233 ———

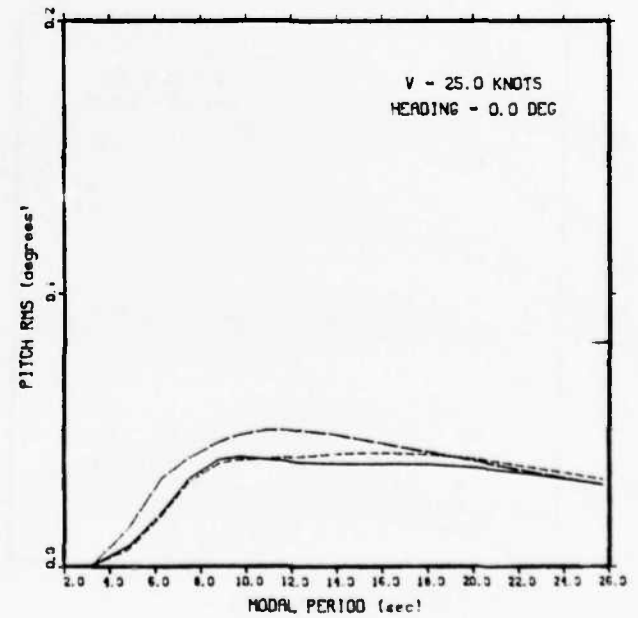
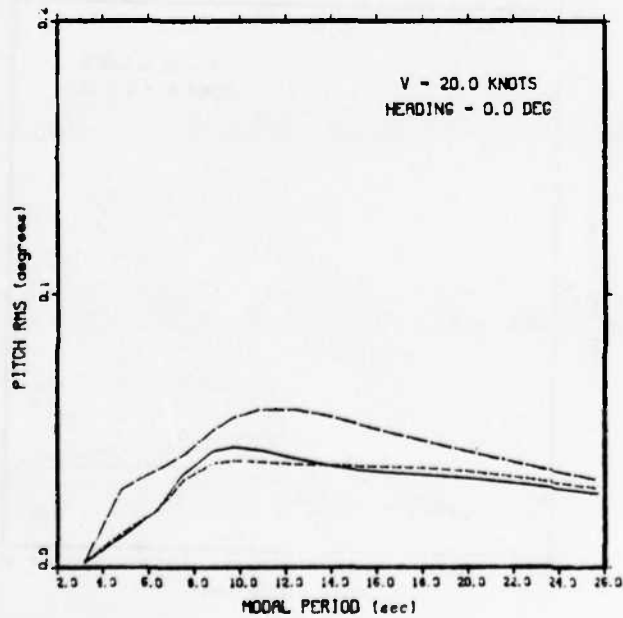
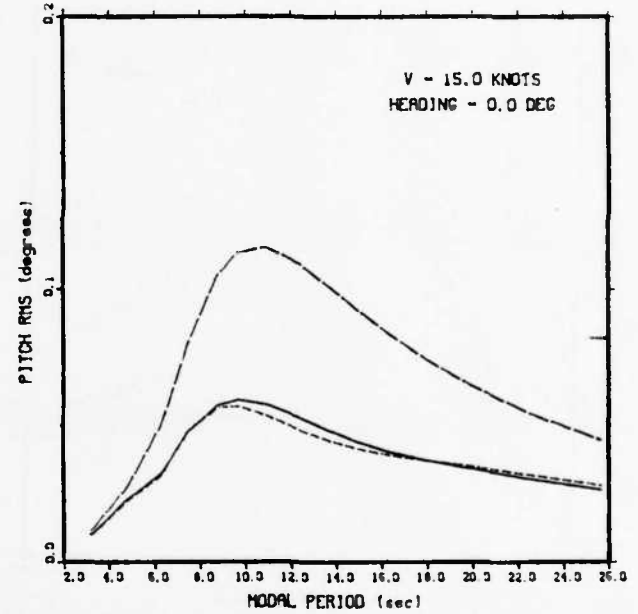
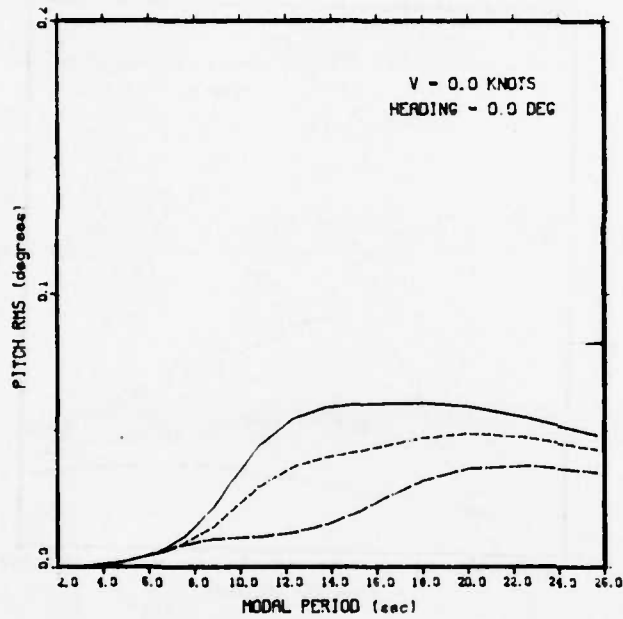


Figure 7o - Responses for Configurations 2231, 2232, and 2233

FIGURE 7 - CONTINUED

2311 —————
 2312 - - - - -
 2313 - - - - -

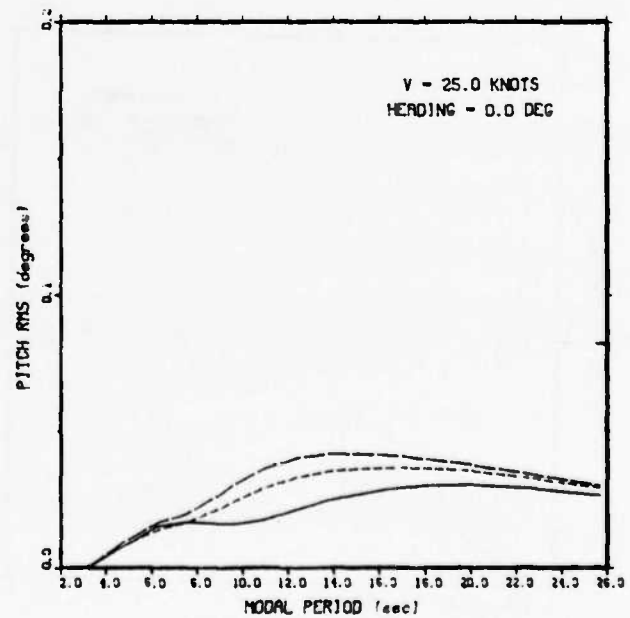
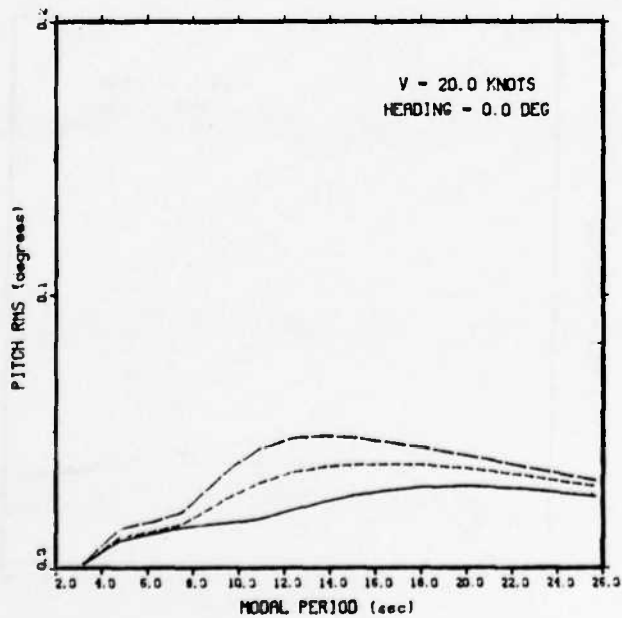
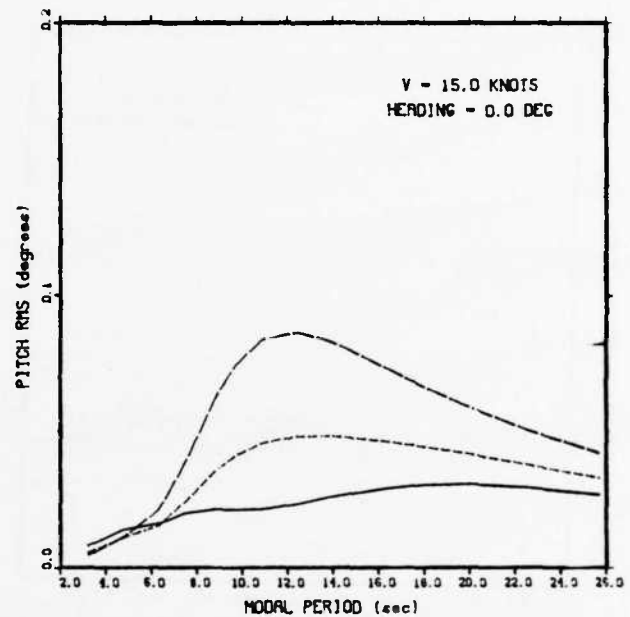
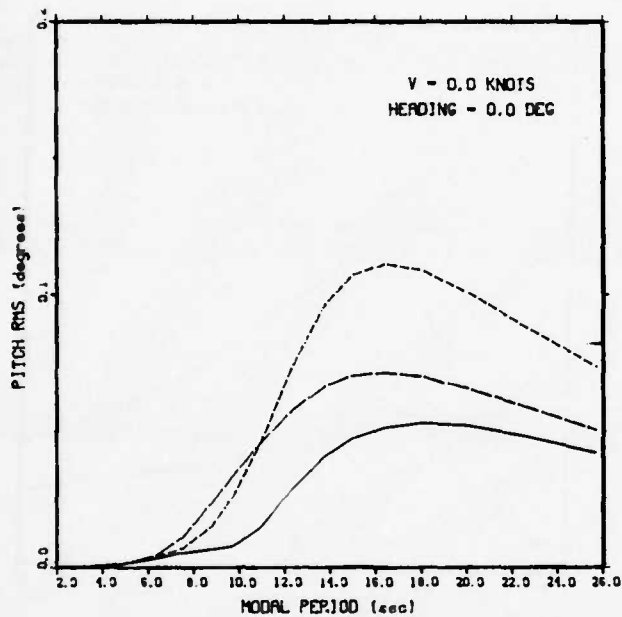


Figure 7p - Responses for Configurations 2311, 2312, and 2313

FIGURE 7 - CONTINUED

2321 -----
 2322 -----
 2323 -----

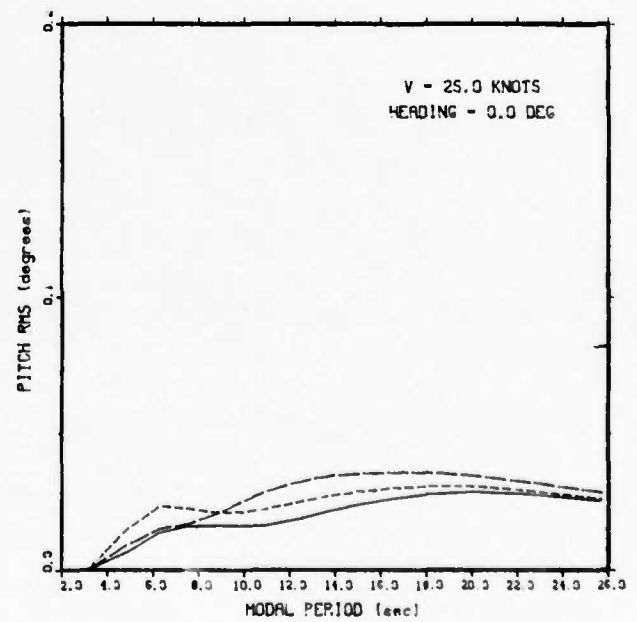
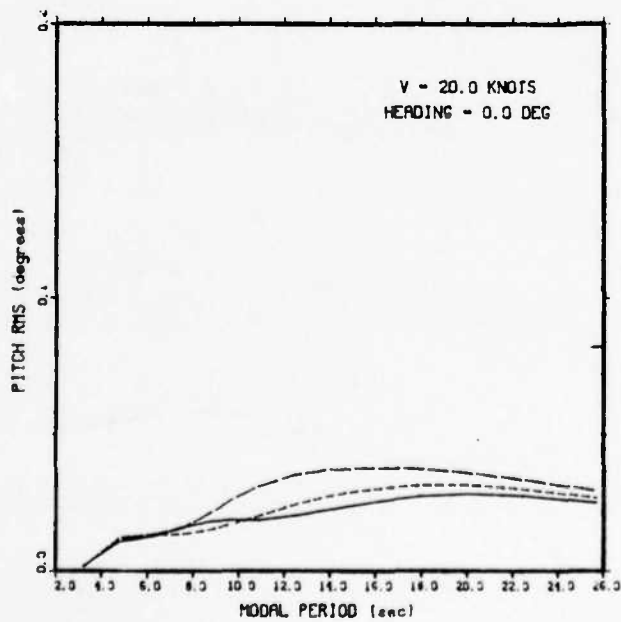
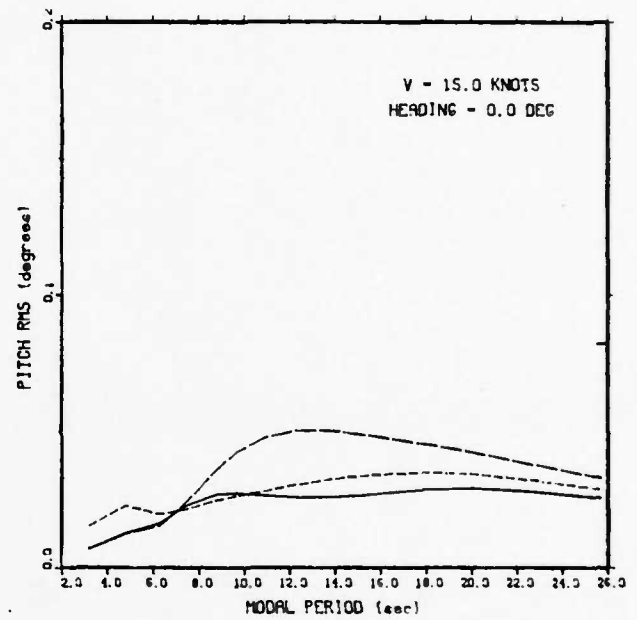
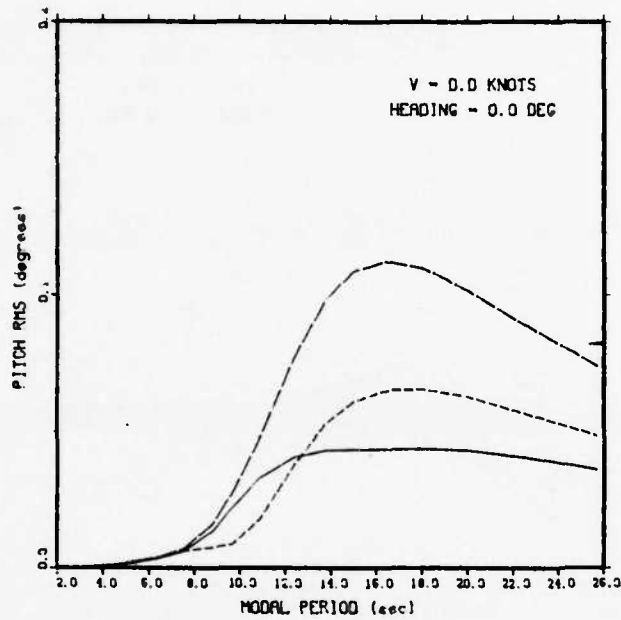


Figure 7q - Responses for Configurations 2321, 2322, and 2323

FIGURE 7 - CONTINUED

2331 —————
 2332 - - - - -
 2333 - · - · - ·

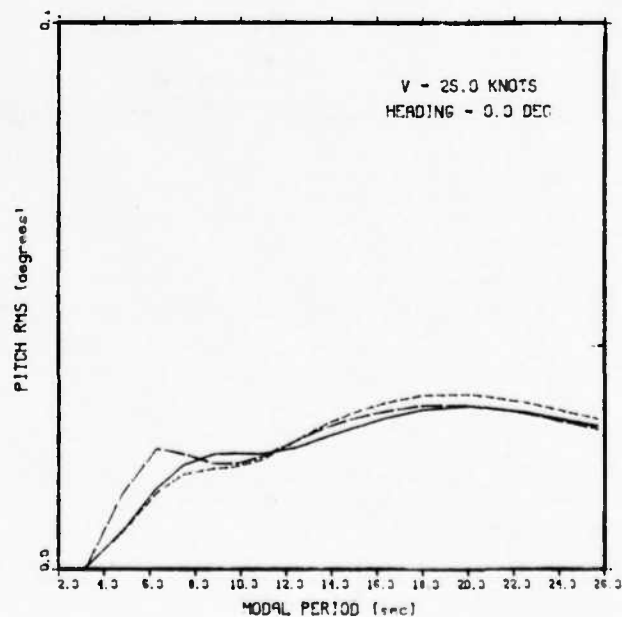
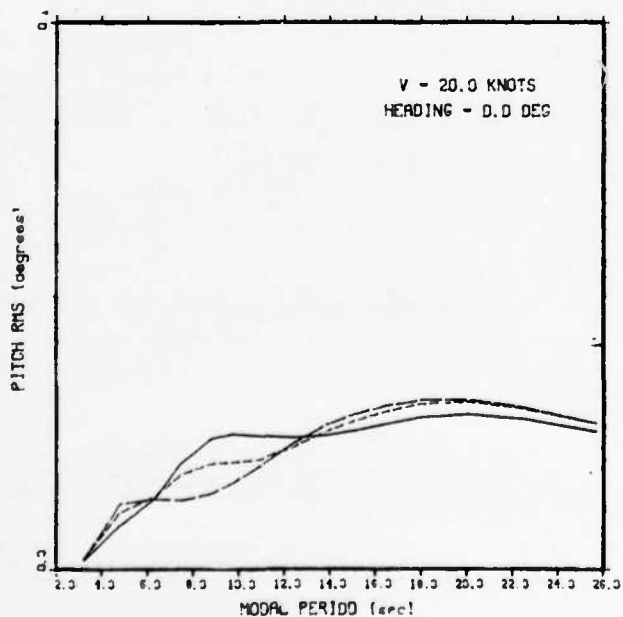
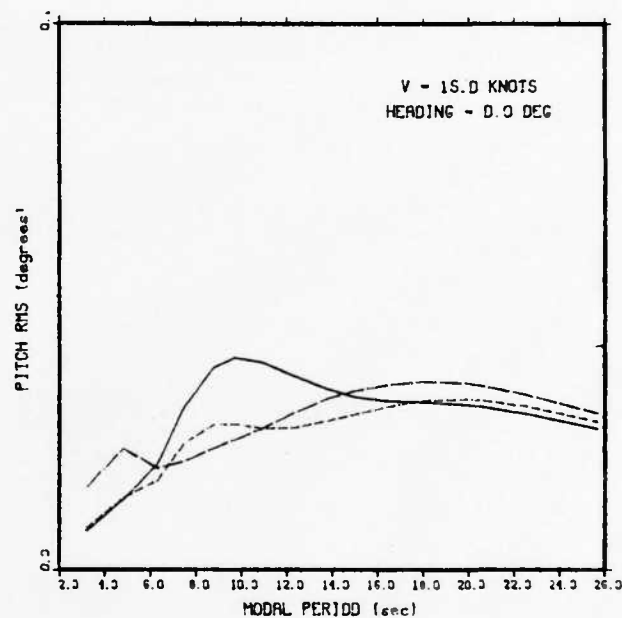
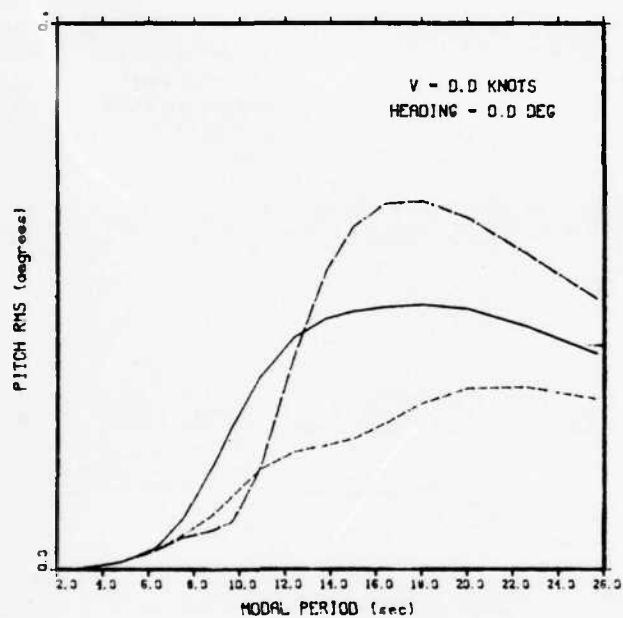


Figure 7r - Responses for Configurations 2331, 2332, and 2333

FIGURE 7 - CONTINUED

3111 —————
 3112 - - - - -
 3113 - - - - -

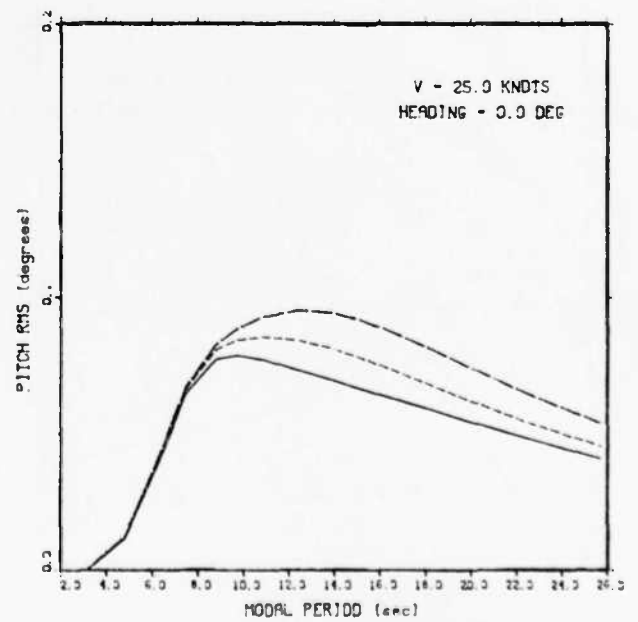
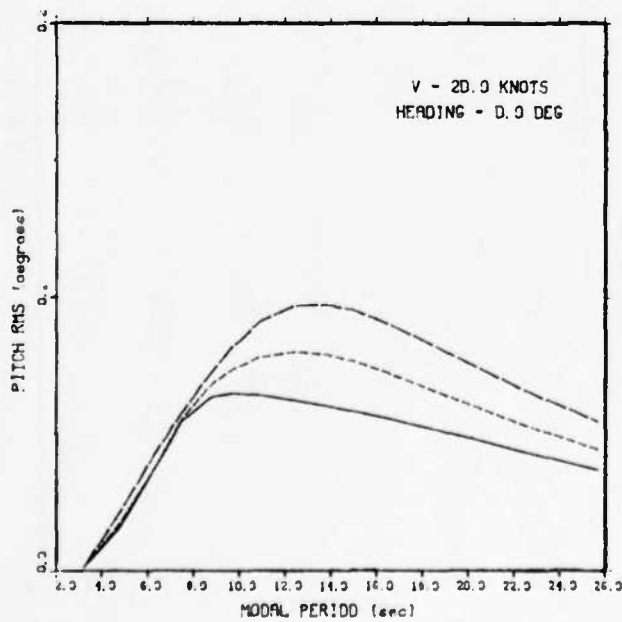
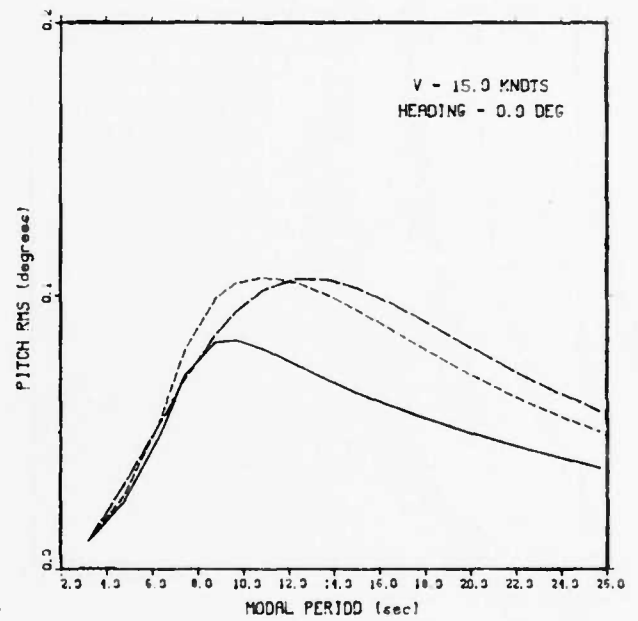
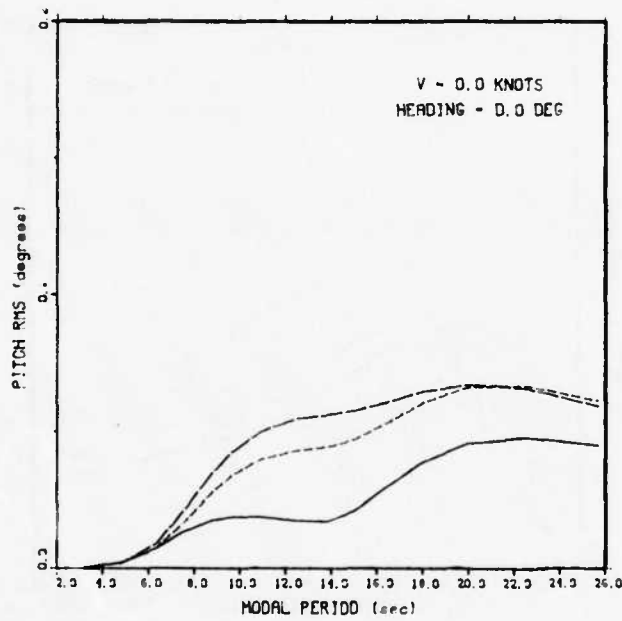


Figure 7s - Responses for Configurations 3111, 3112, and 3113

FIGURE 7 - CONTINUED

3121 ———
3122 - - -
3123 - . .

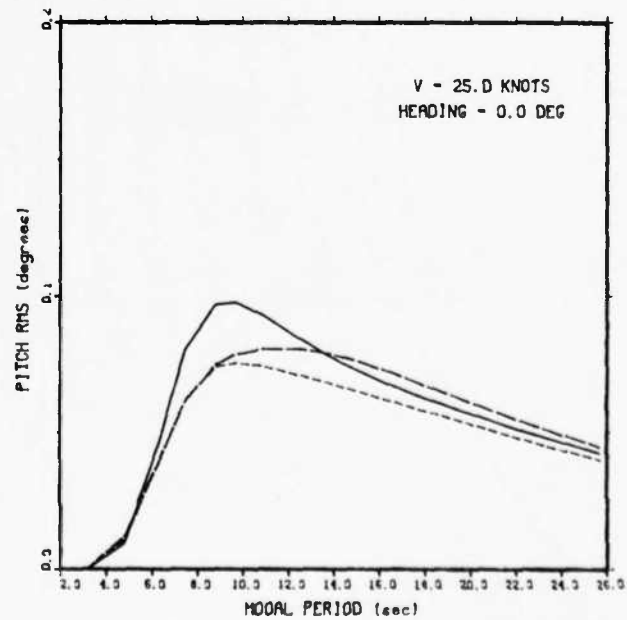
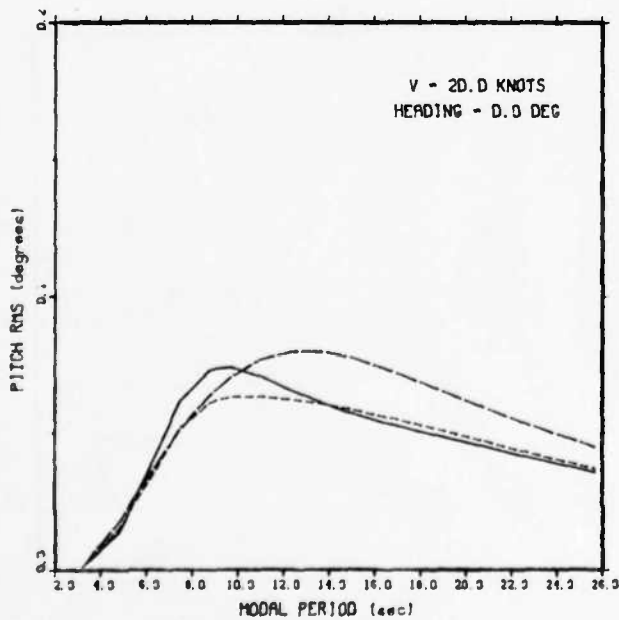
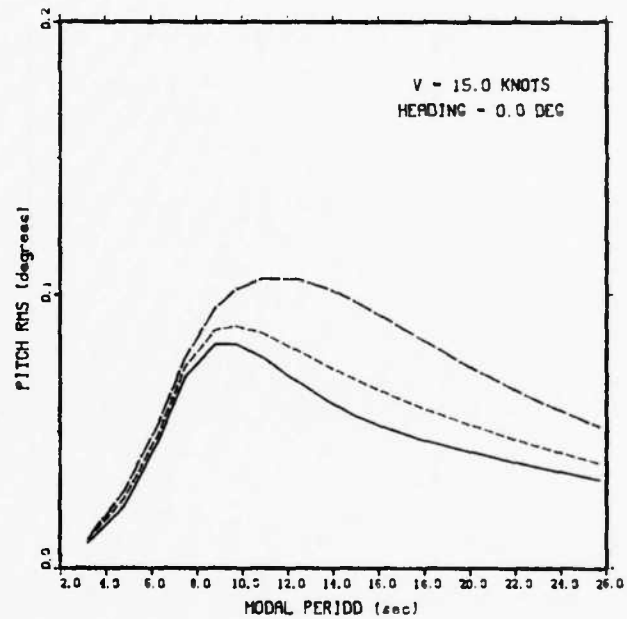
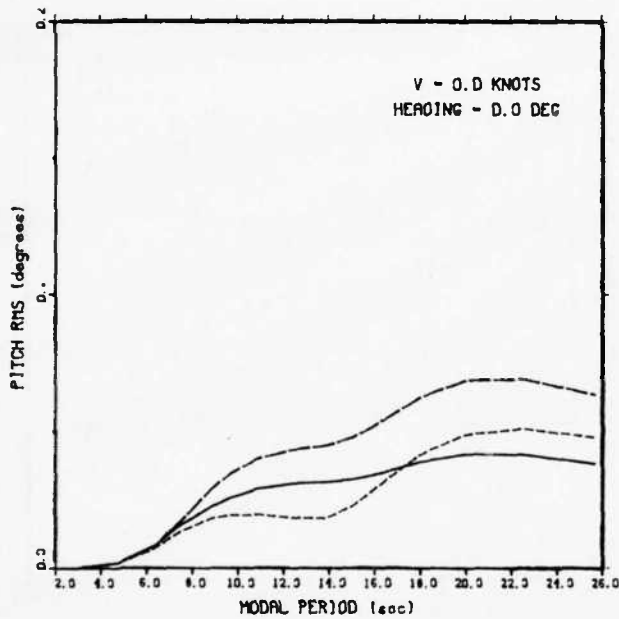


Figure 7t - Responses for Configurations 3121, 3122, and 3123

FIGURE 7 - CONTINUED

3132 - - - - -
3133 - - - - -

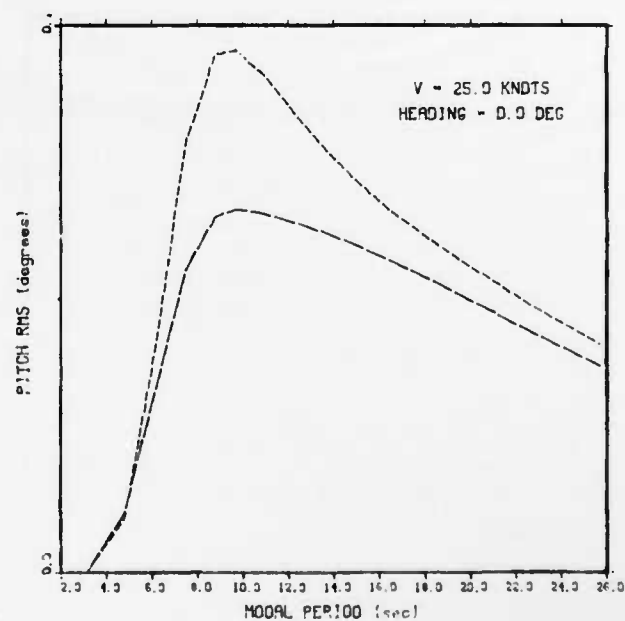
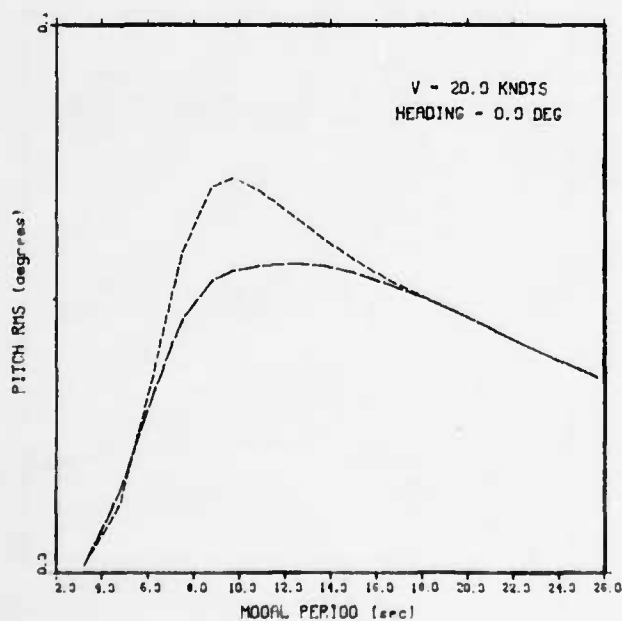
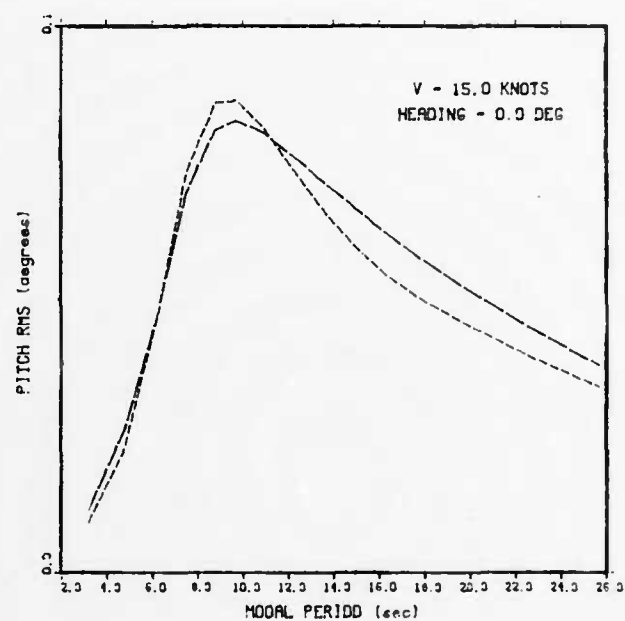
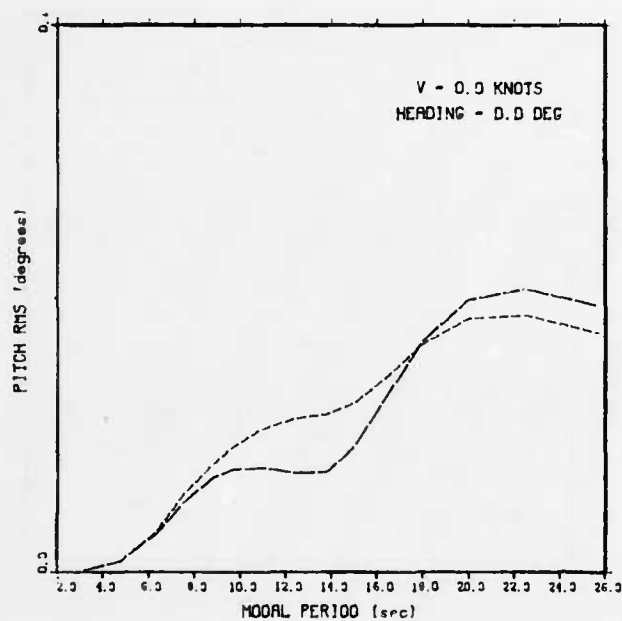


Figure 7u - Responses for Configurations 3132 and 3133

FIGURE 7 - CONTINUED

3211 —————
 3212 - - - - -
 3213 - - - - -

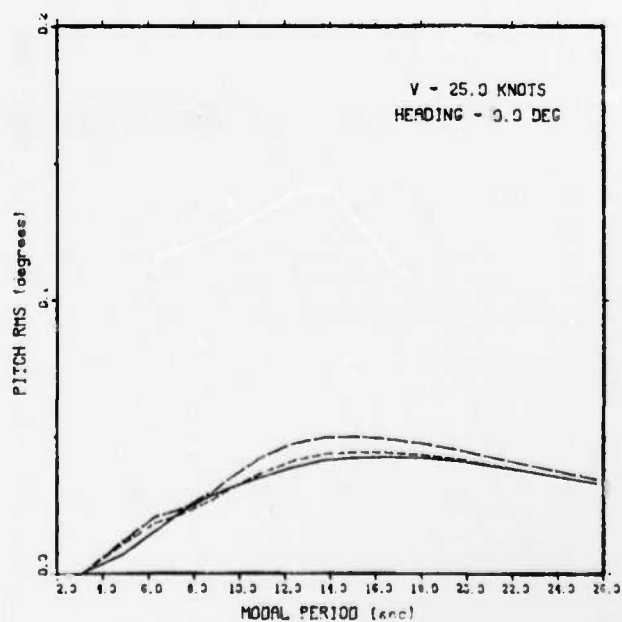
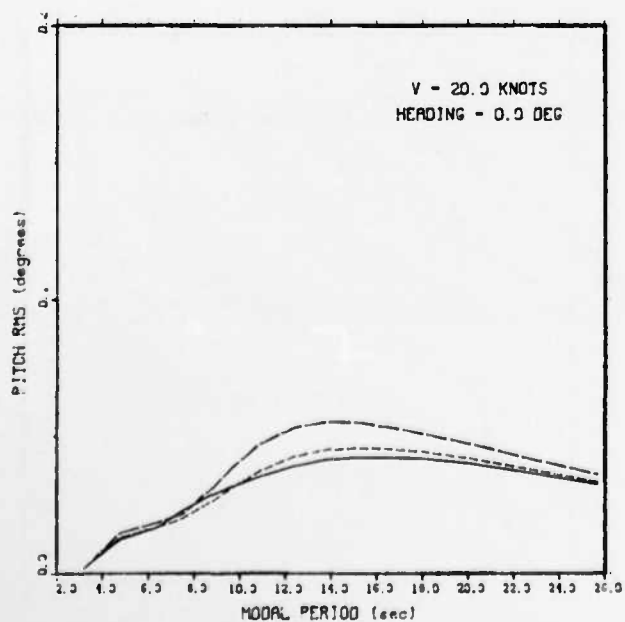
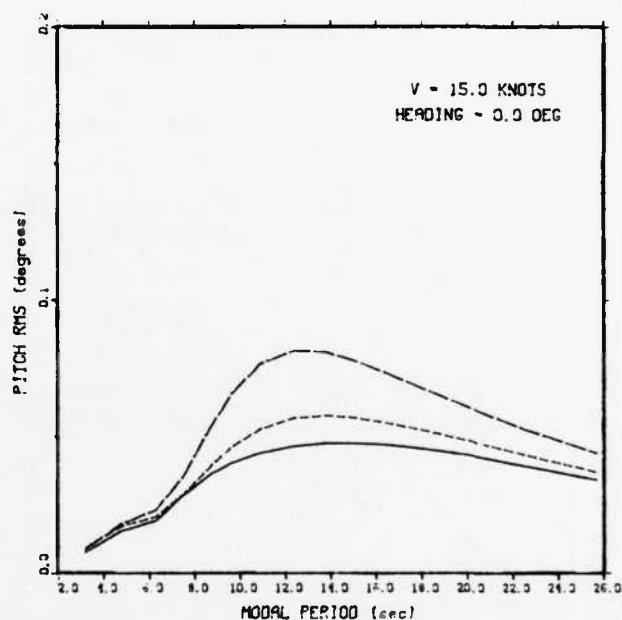
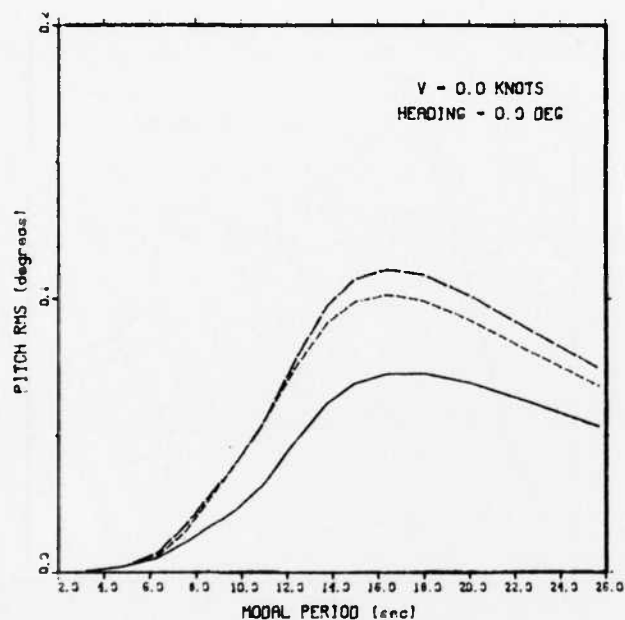


Figure 7v - Responses for Configurations 3211, 3212, and 3213

FIGURE 7 - CONTINUED

3221 —————
 3222 - - - - -
 3223 — · — · —

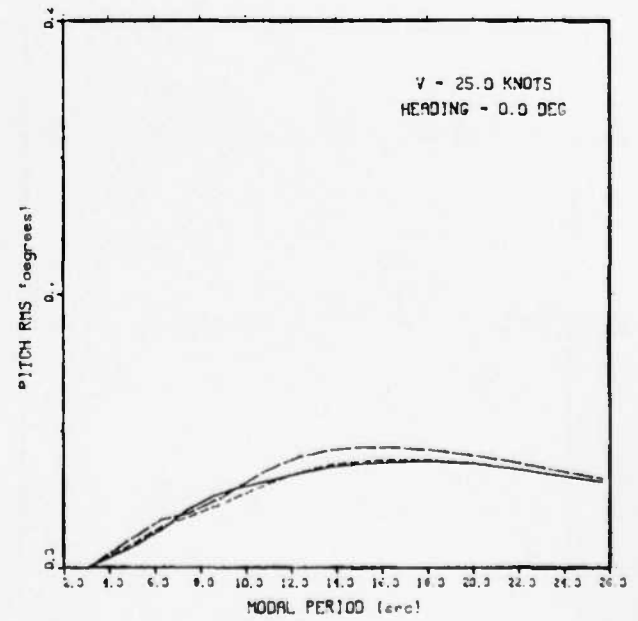
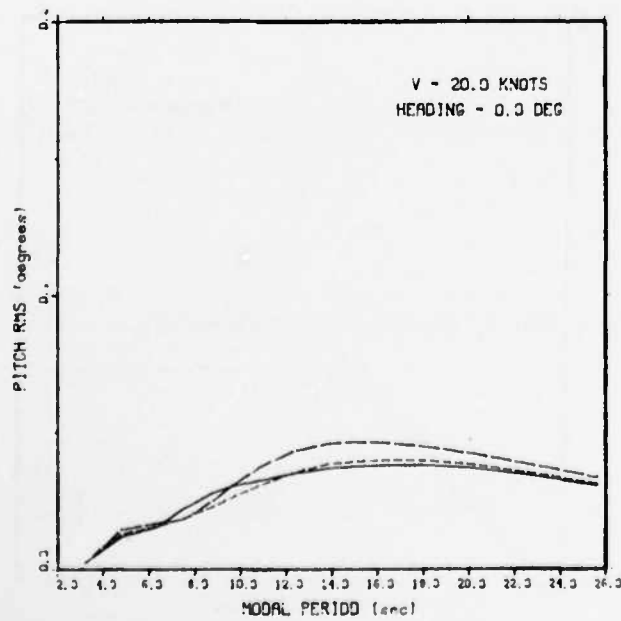
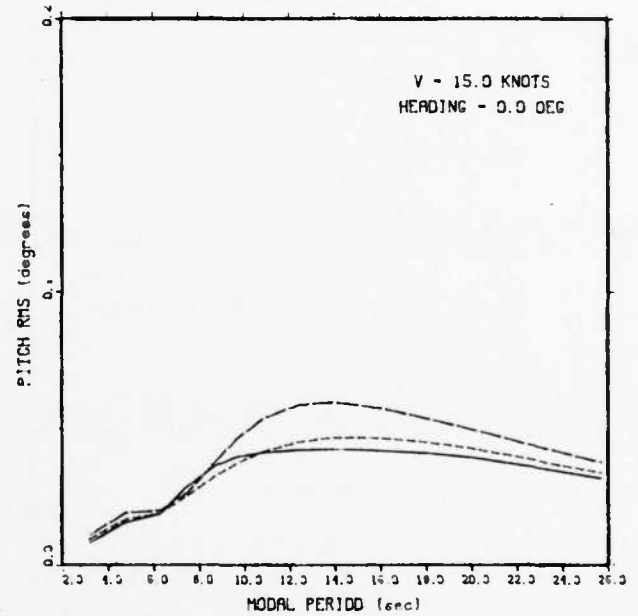
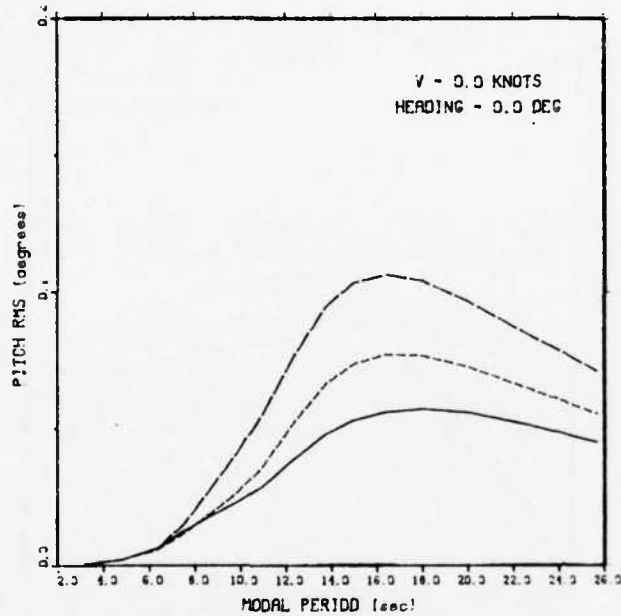


Figure 7w - Responses for Configurations 3221, 3222, and 3223

FIGURE 7 - CONTINUED

3231 —————
 3232 - - - - -
 3233 —————

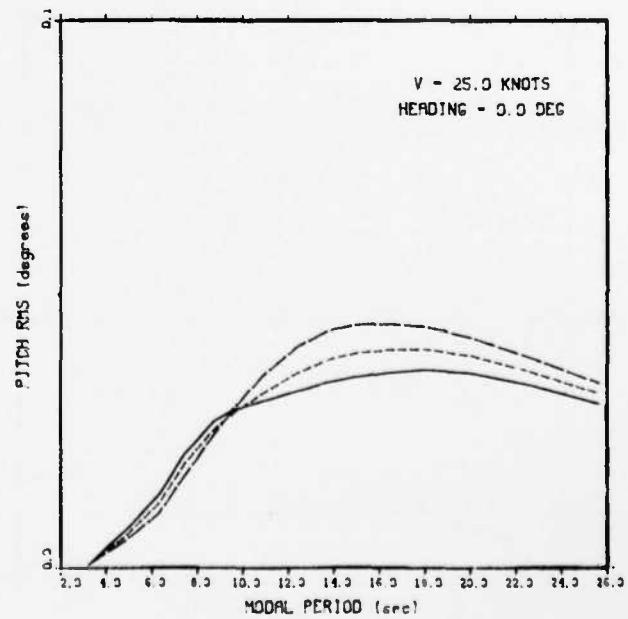
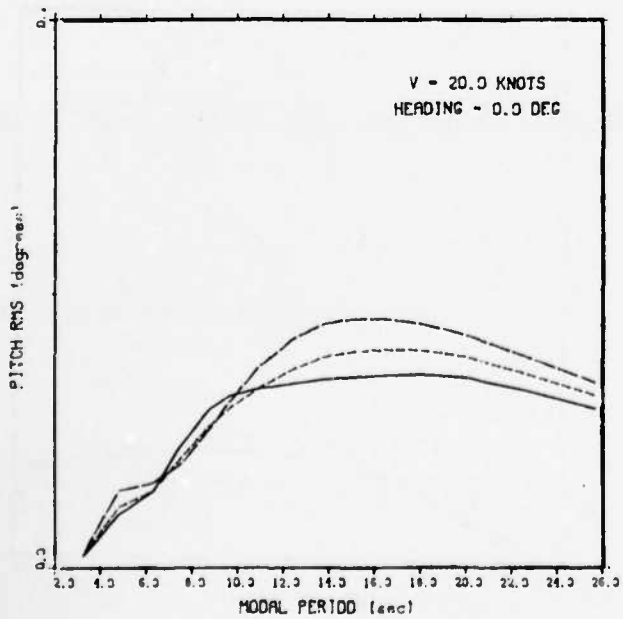
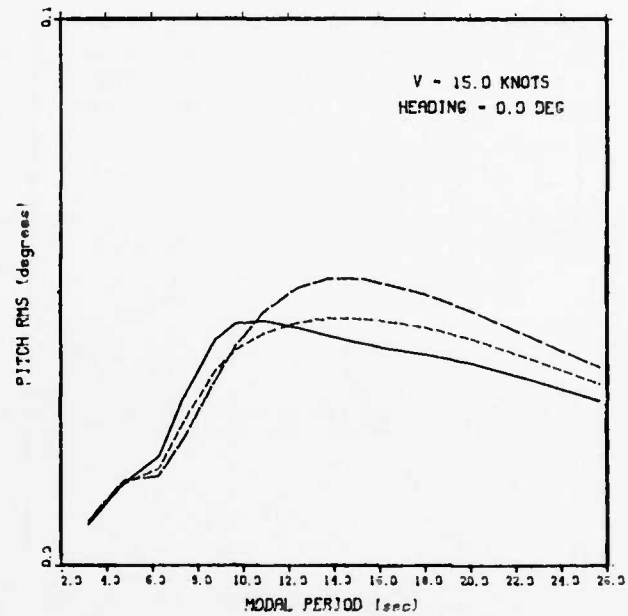
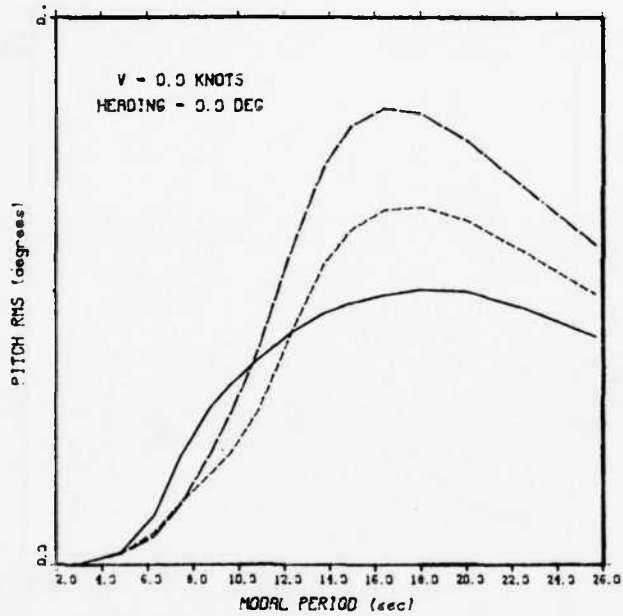


Figure 7x - Responses for Configurations 3231, 3232, and 3233

FIGURE 7 - CONTINUED

3311 —————
 3312 - - - - -
 3313 - - - - -

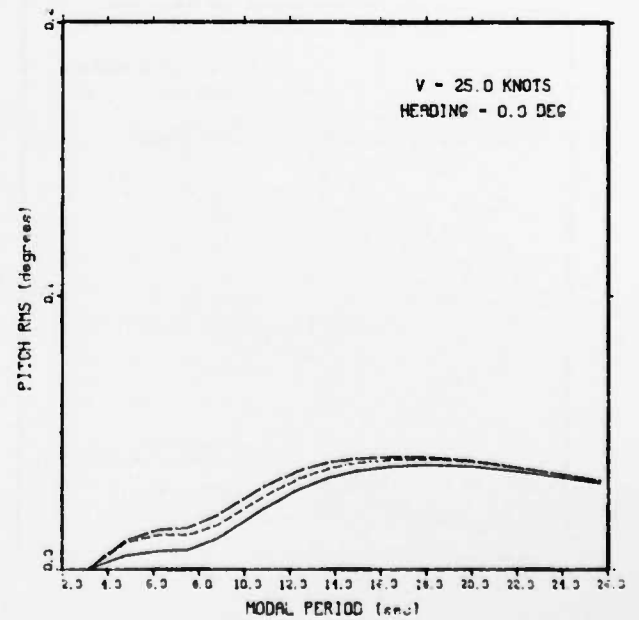
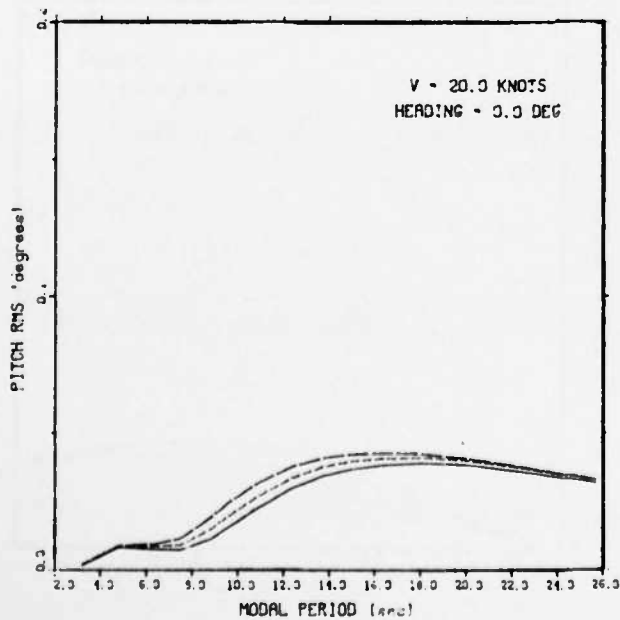
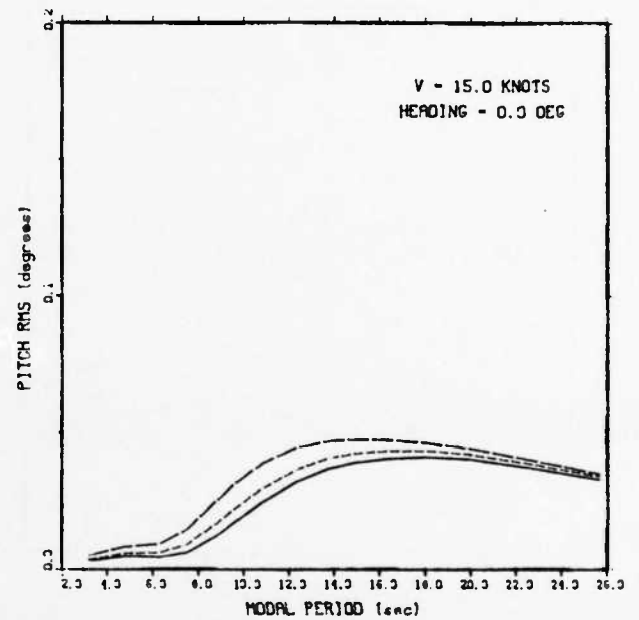
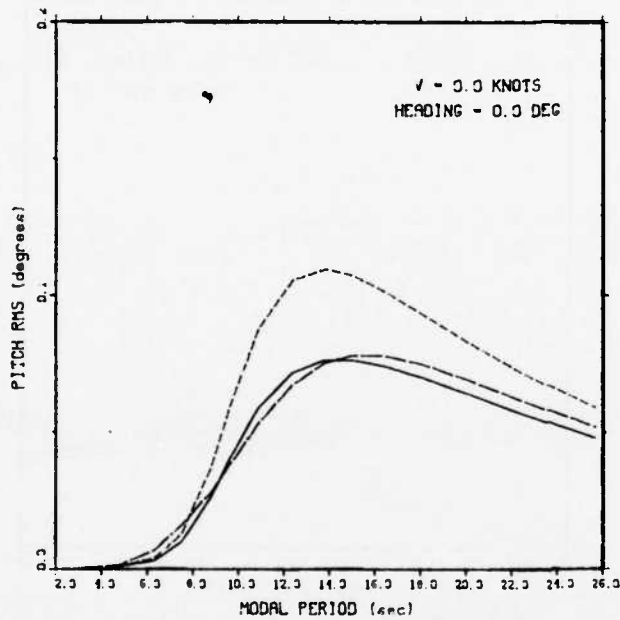


Figure 7y - Responses for Configurations 3311, 3312, and 3313

FIGURE 7 - CONTINUED

3321 ———
3322 - - -
3323 ———

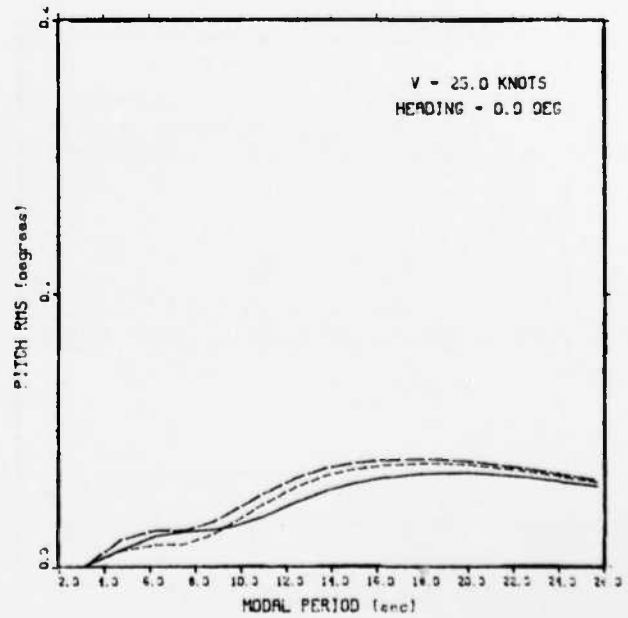
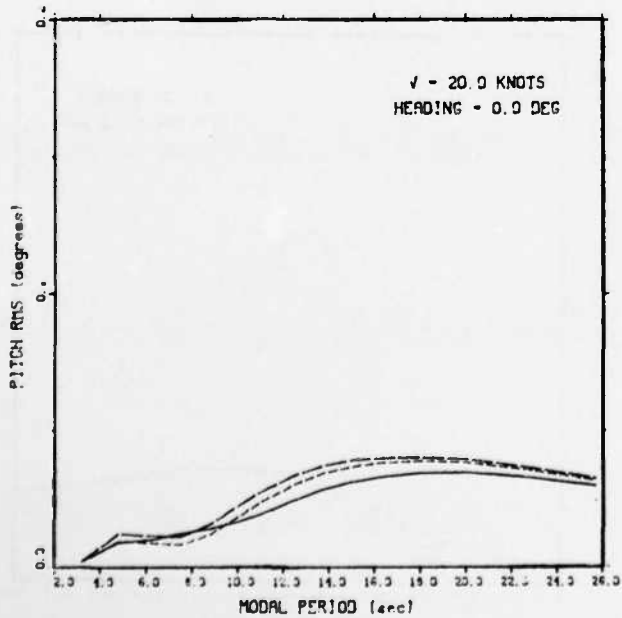
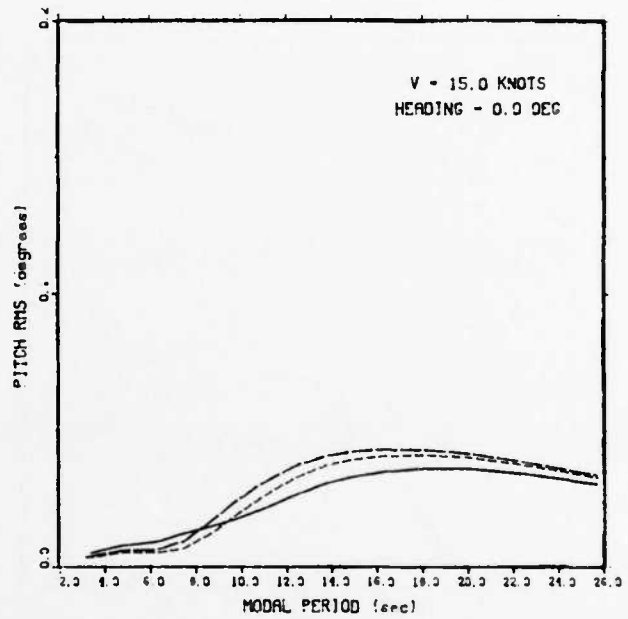
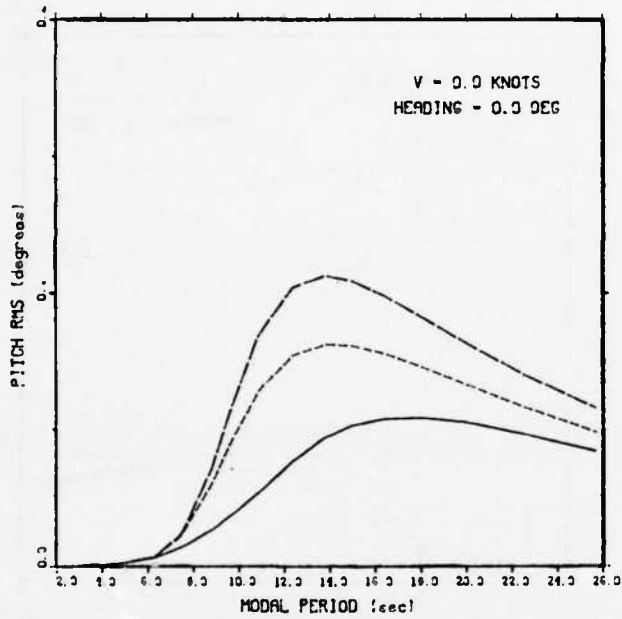


Figure 7z - Responses for Configurations 3321, 3322, and 3323

FIGURE 7 - CONTINUED

3331 ———
 3332 - - -
 3333 - - -

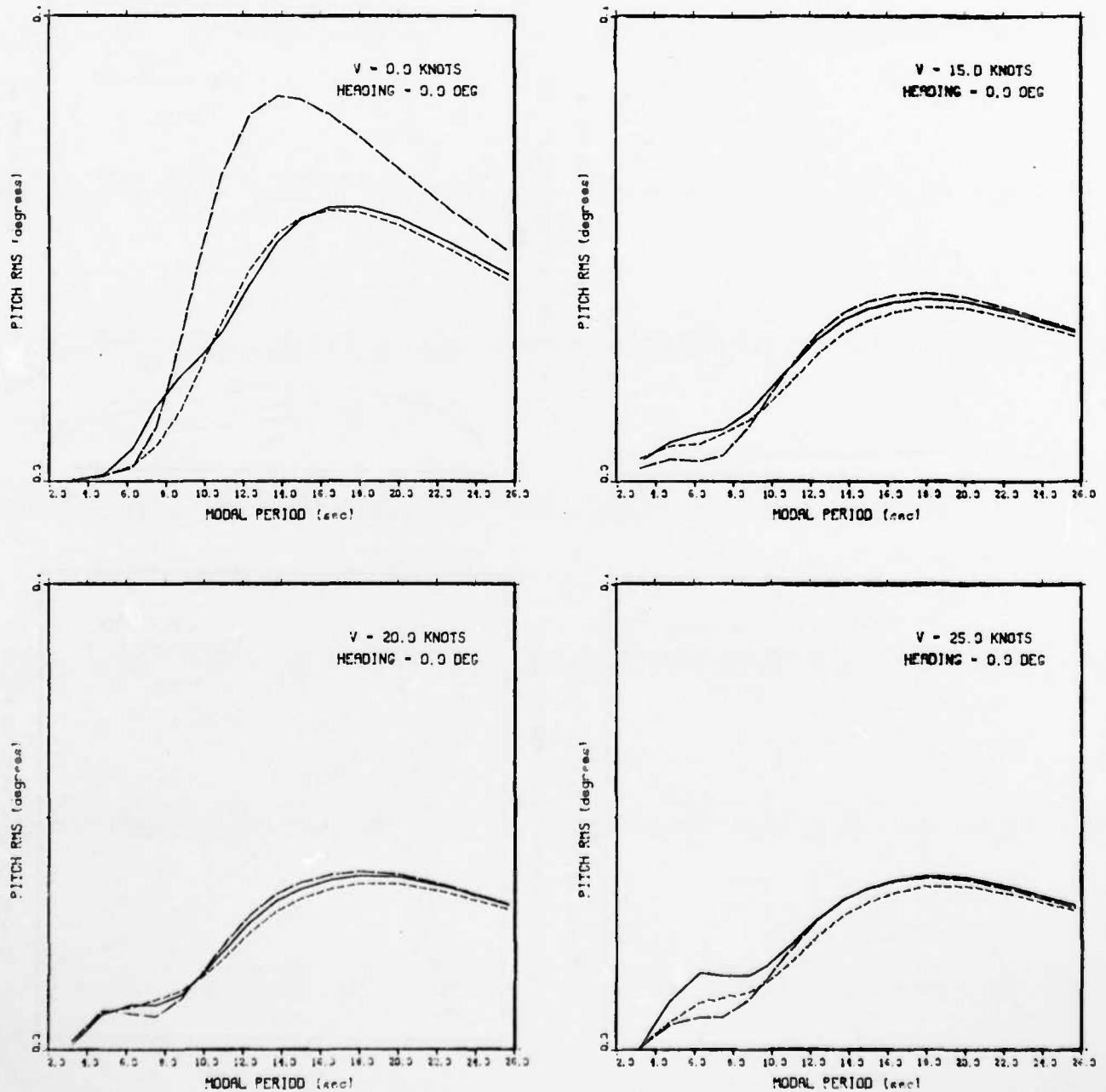


Figure 7aa - Responses for Configurations 3331, 3332, and 3333

FIGURE 8 - RELATIVE BOW MOTION RMS RESPONSES IN FOLLOWING SEAS

1111 —————
1112 - - - - -
1113 -

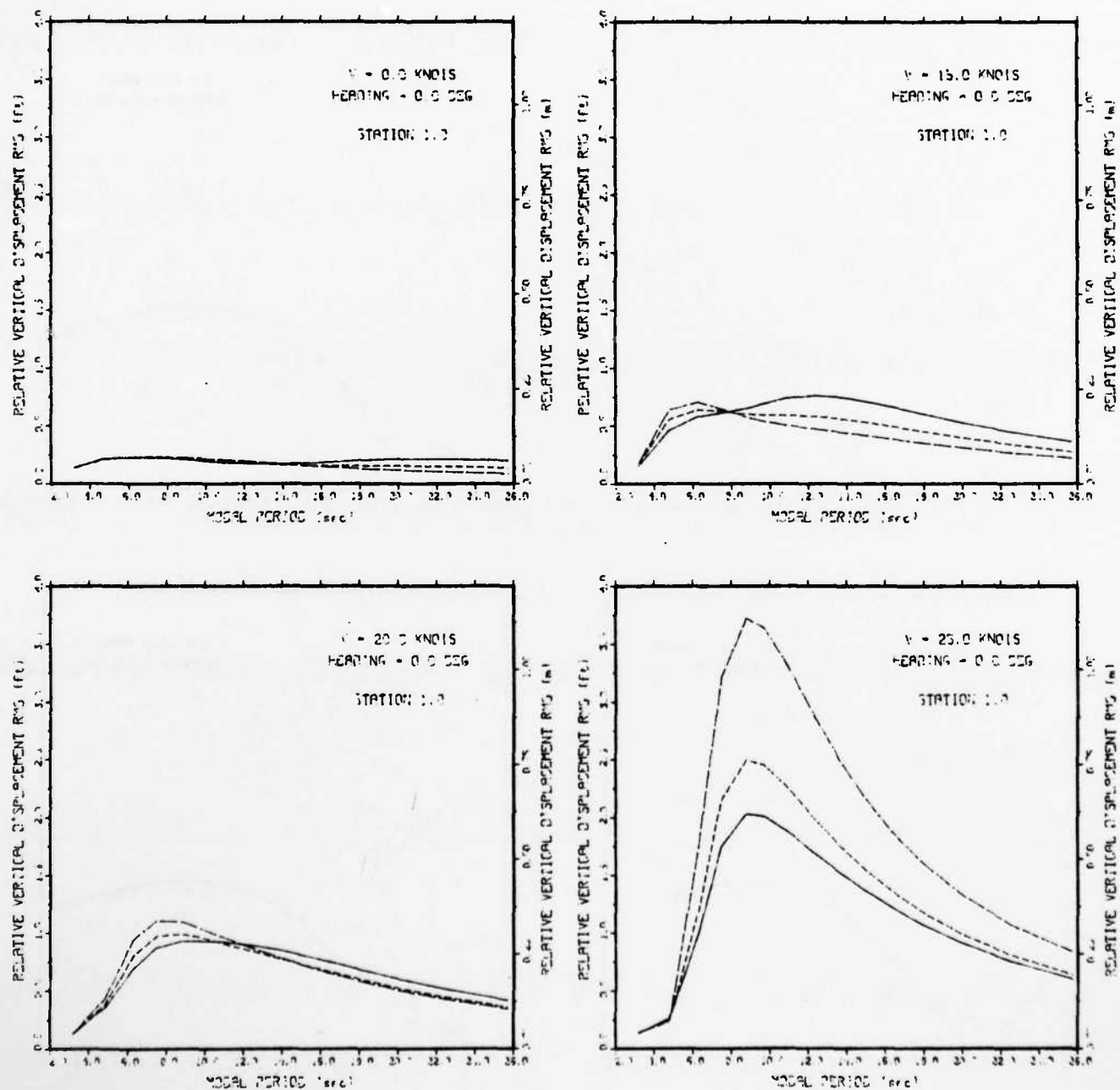


Figure 8a - Responses for Configurations 1111, 1112, and 1113

FIGURE 8 - CONTINUED

1121 —————
1122 - - - - -
1123 - - - - -

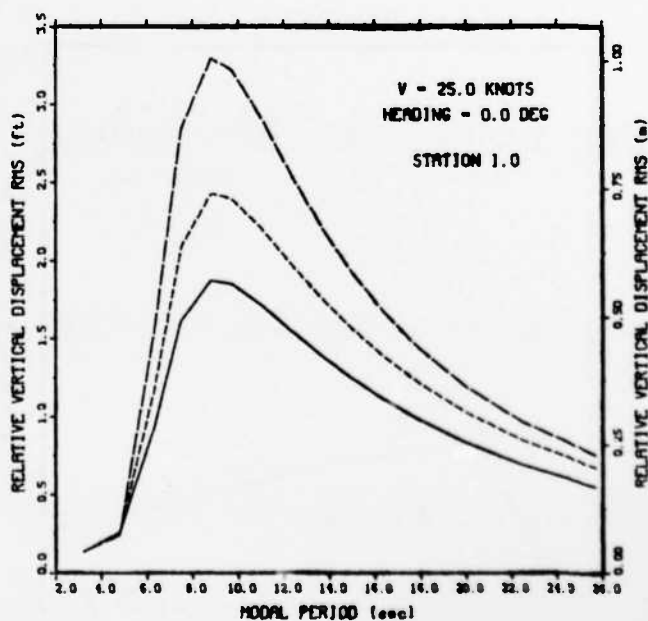
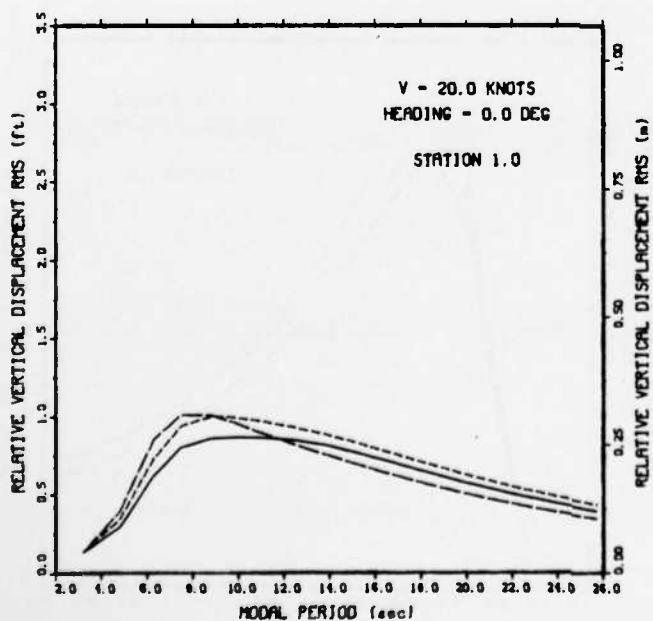
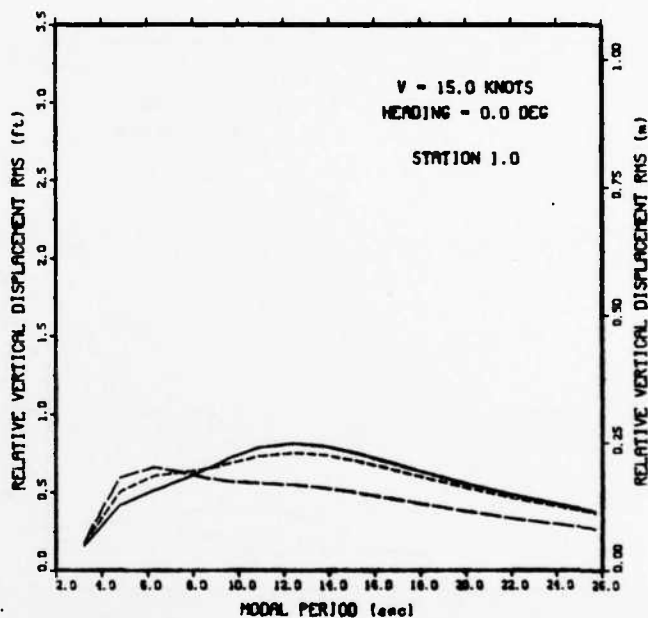
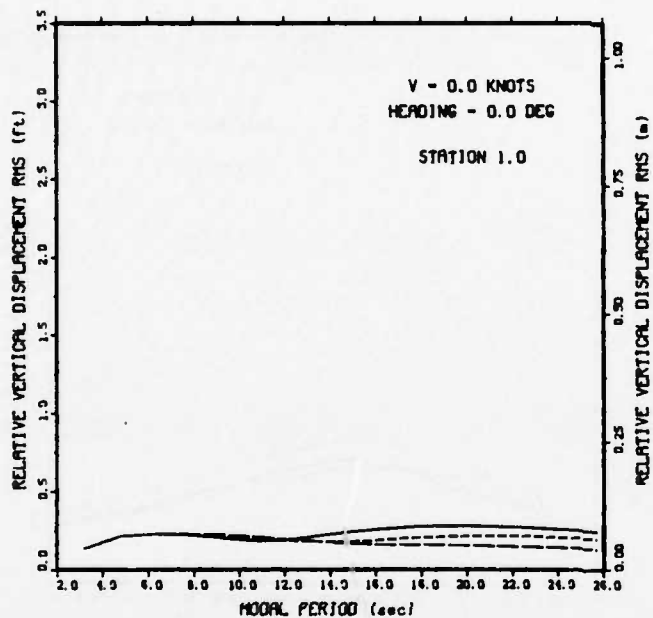


Figure 8b - Responses for Configurations 1121, 1122, and 1123

FIGURE 8 - CONTINUED

1131 - - - - -
1132 - - - - -
1133 - - - - -

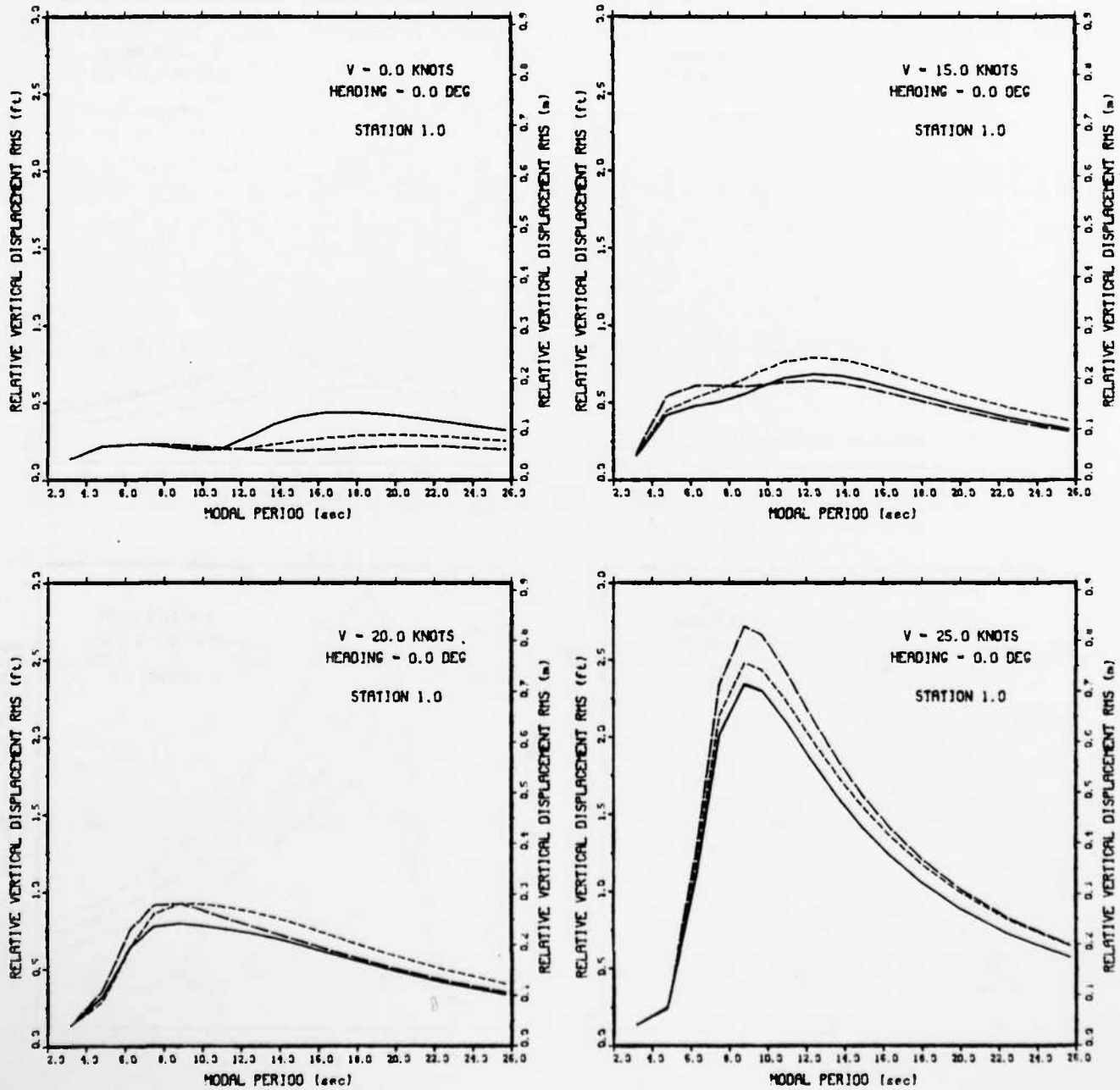


Figure 8c - Responses for Configurations 1131, 1132, and 1133

FIGURE 8 - CONTINUED

1211 —————
1212 - - - - -
1213 - - - - -

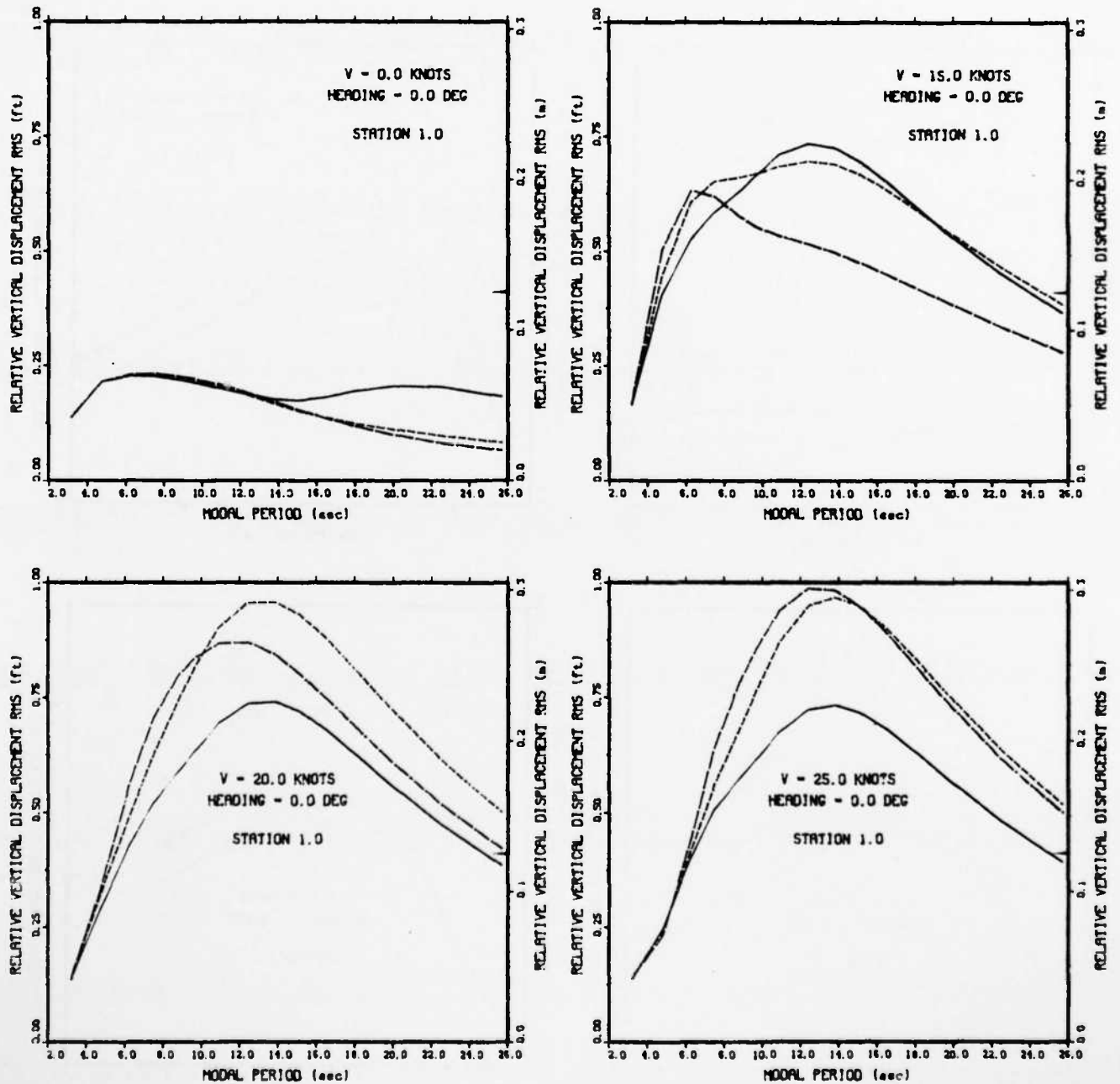


Figure 8d - Responses for Configurations 1211, 1212, and 1213

FIGURE 8 - CONTINUED

1221 -----
1222 -----
1223 -----

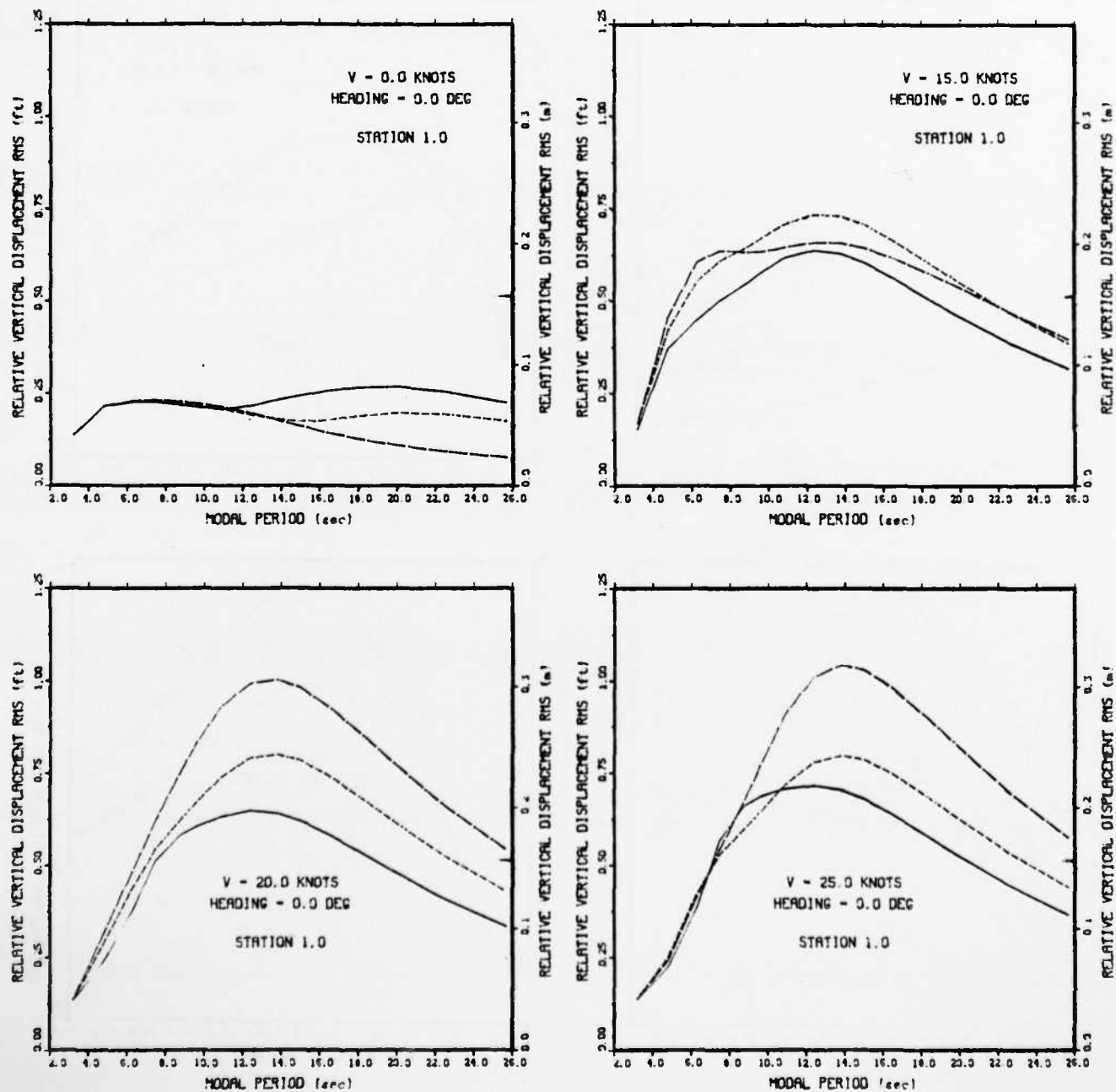


Figure 8e - Responses for Configurations 1221, 1222, and 1223

FIGURE 8 - CONTINUED

1231 ———
1232 - - -
1233 - . .

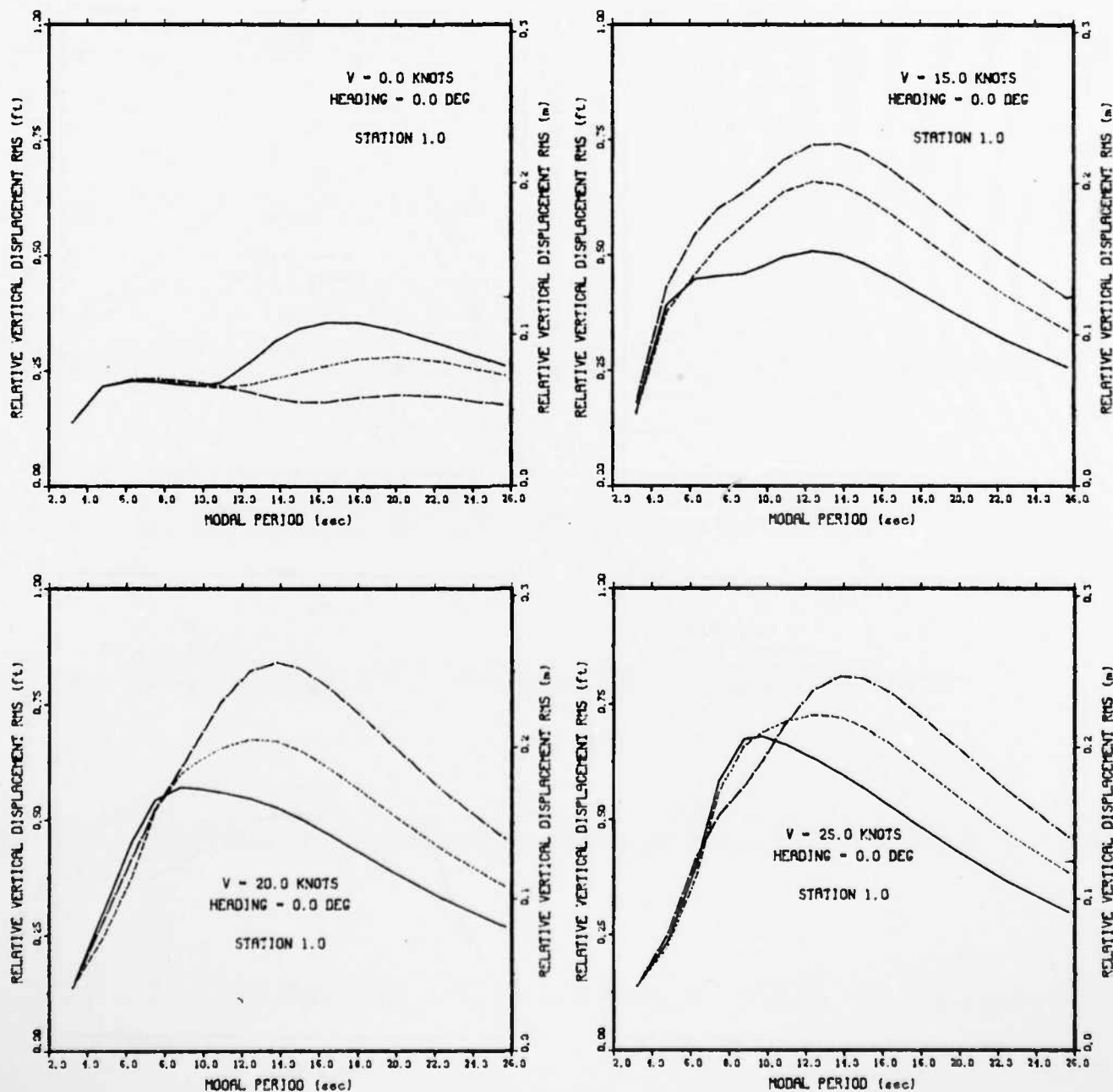


Figure 8f - Responses for Configurations 1231, 1232, and 1233

FIGURE 8 - CONTINUED

1311 —————
1312 - - - - -
1313 - - - - -

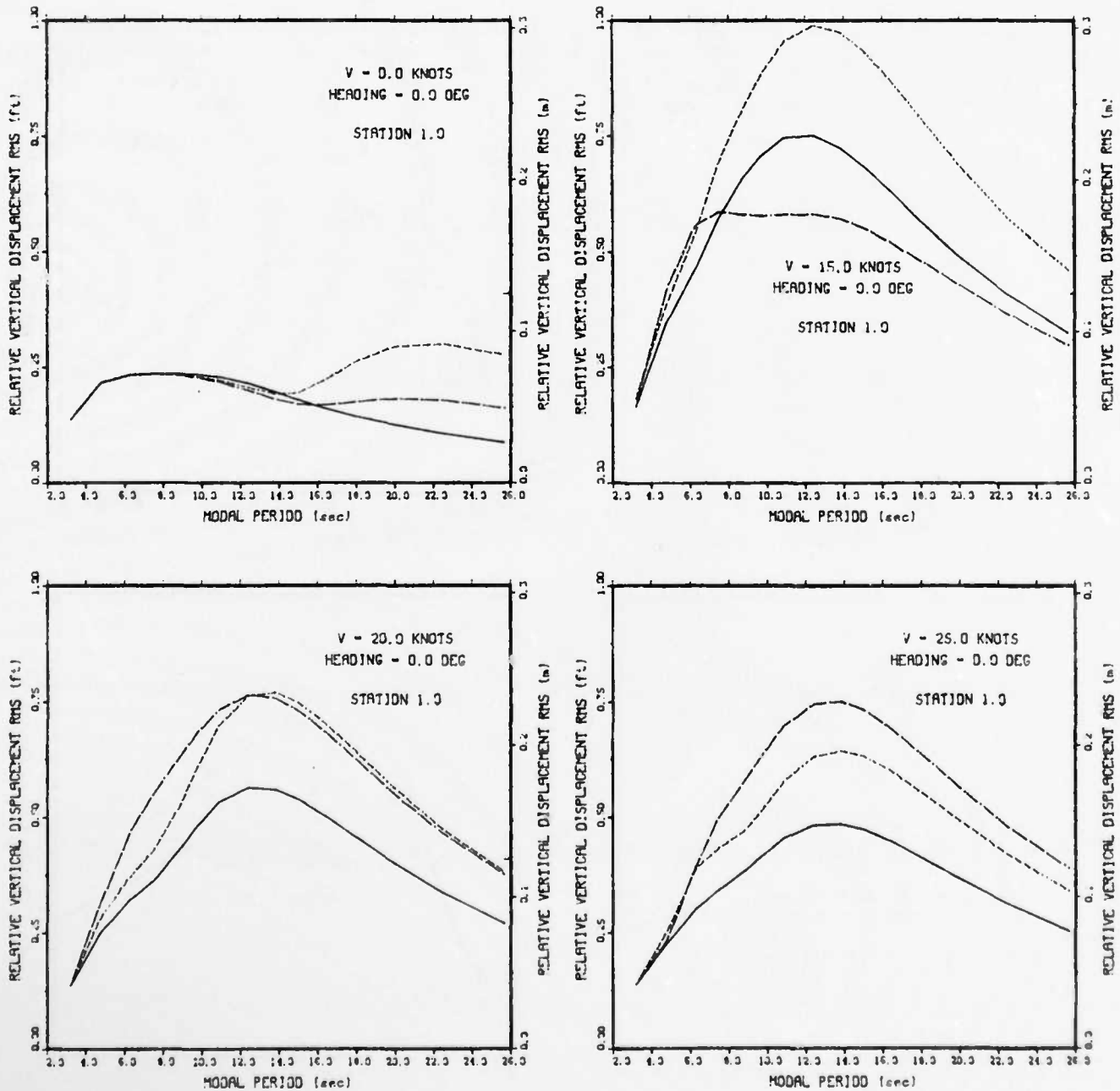


Figure 8g - Responses for Configurations 1311, 1312, and 1313

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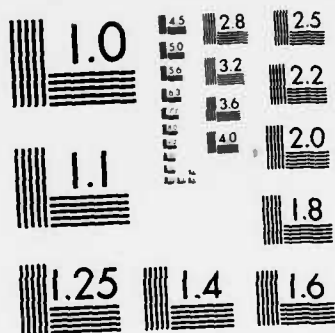
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FIGURE 8 - CONTINUED

1321 —————
 1322 - - - - -
 1323 - - - - -

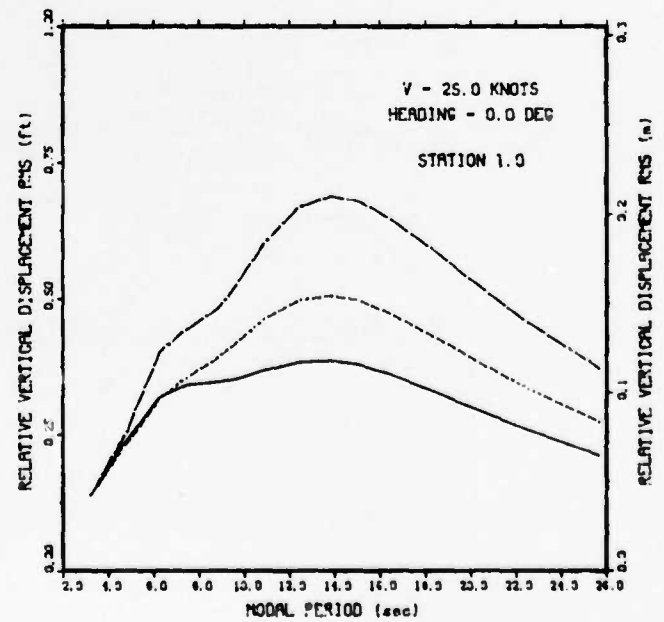
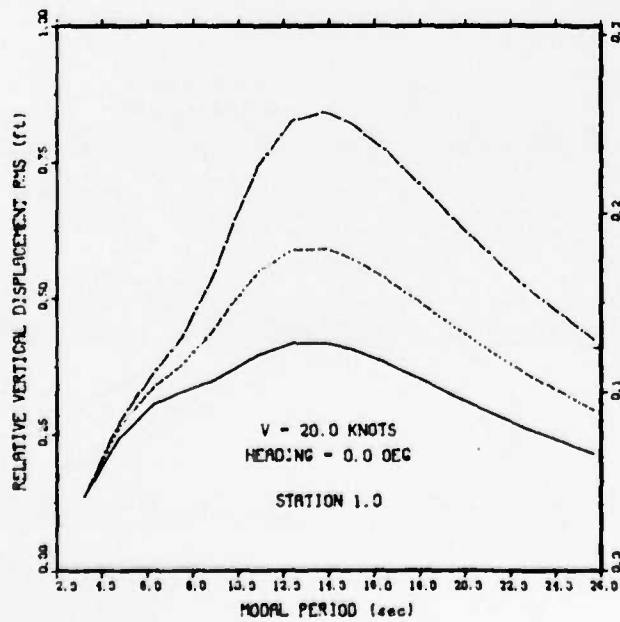
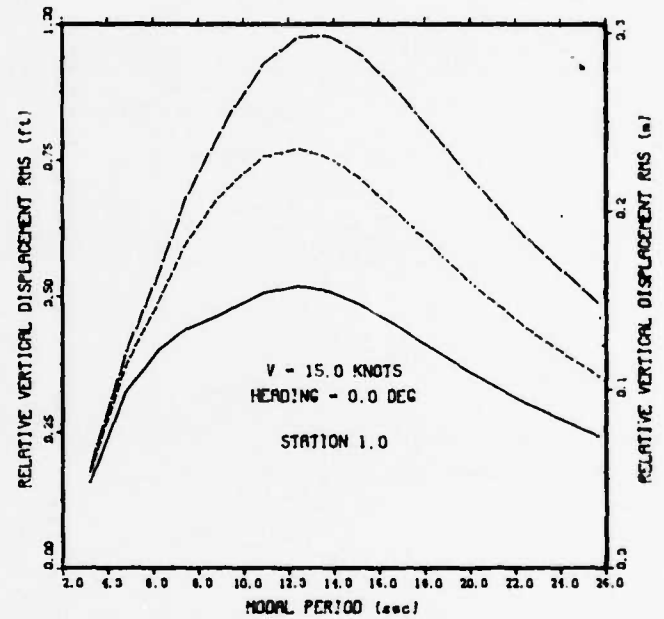
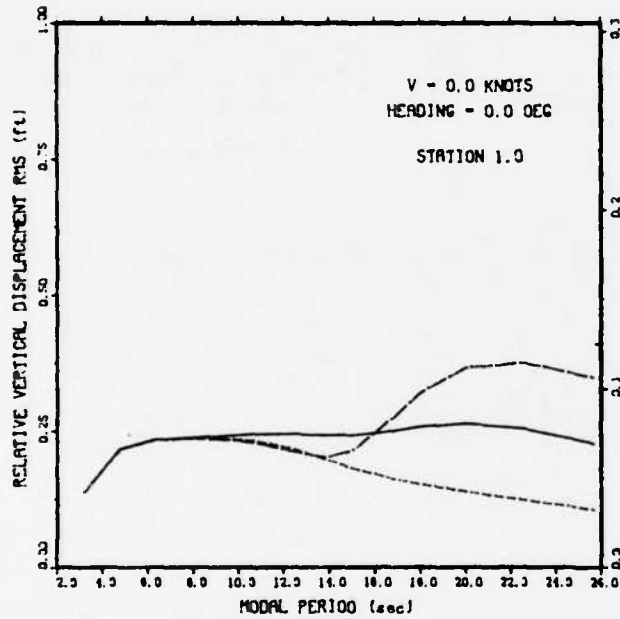


Figure 8h - Responses for Configurations 1321, 1322, and 1323

FIGURE 8 - CONTINUED

1331 - - - - -
1352 - - - - -
1333 - - - - -

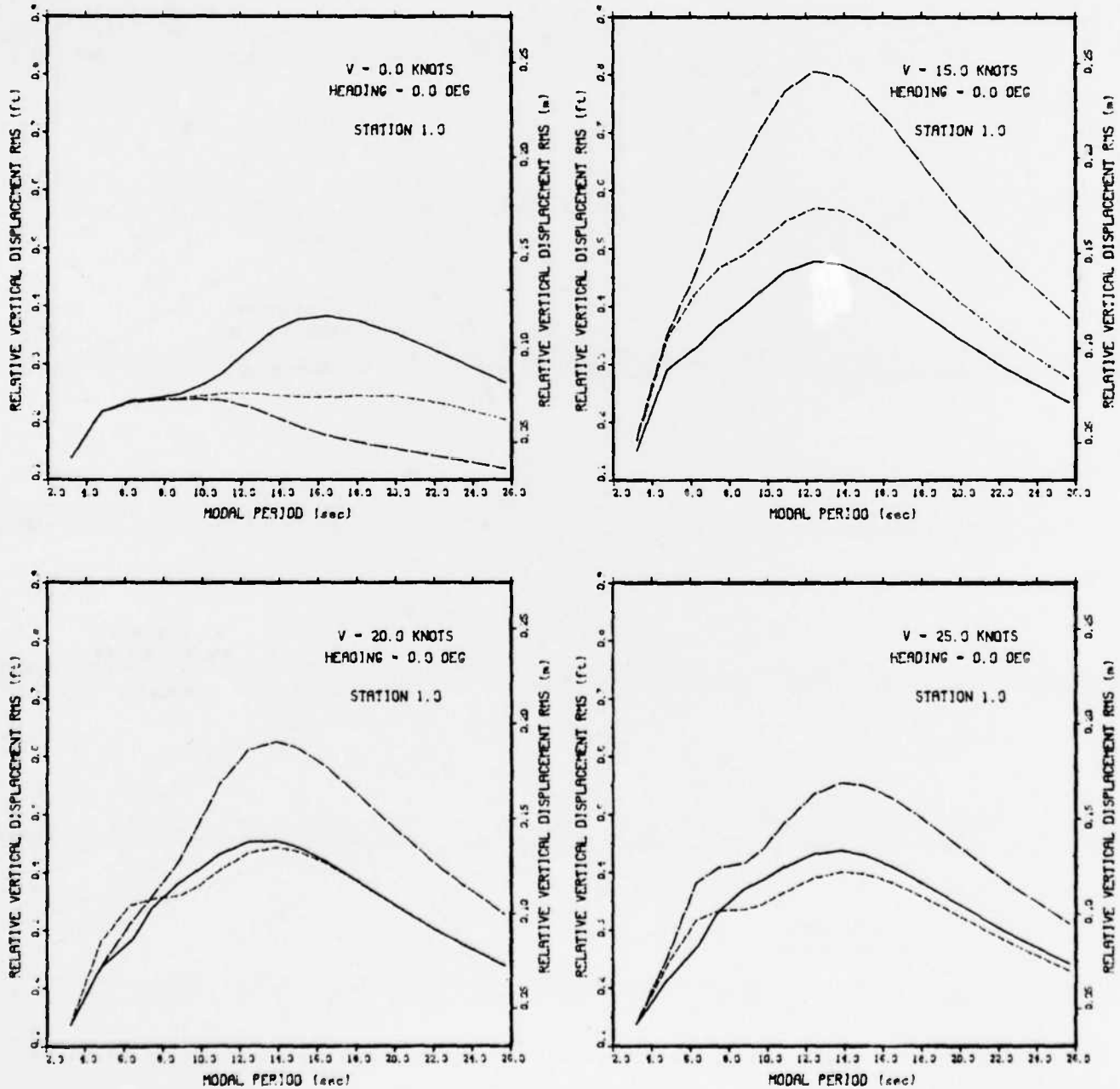


Figure 8i - Responses for Configurations 1331, 1332, and 1333

FIGURE 8 - CONTINUED

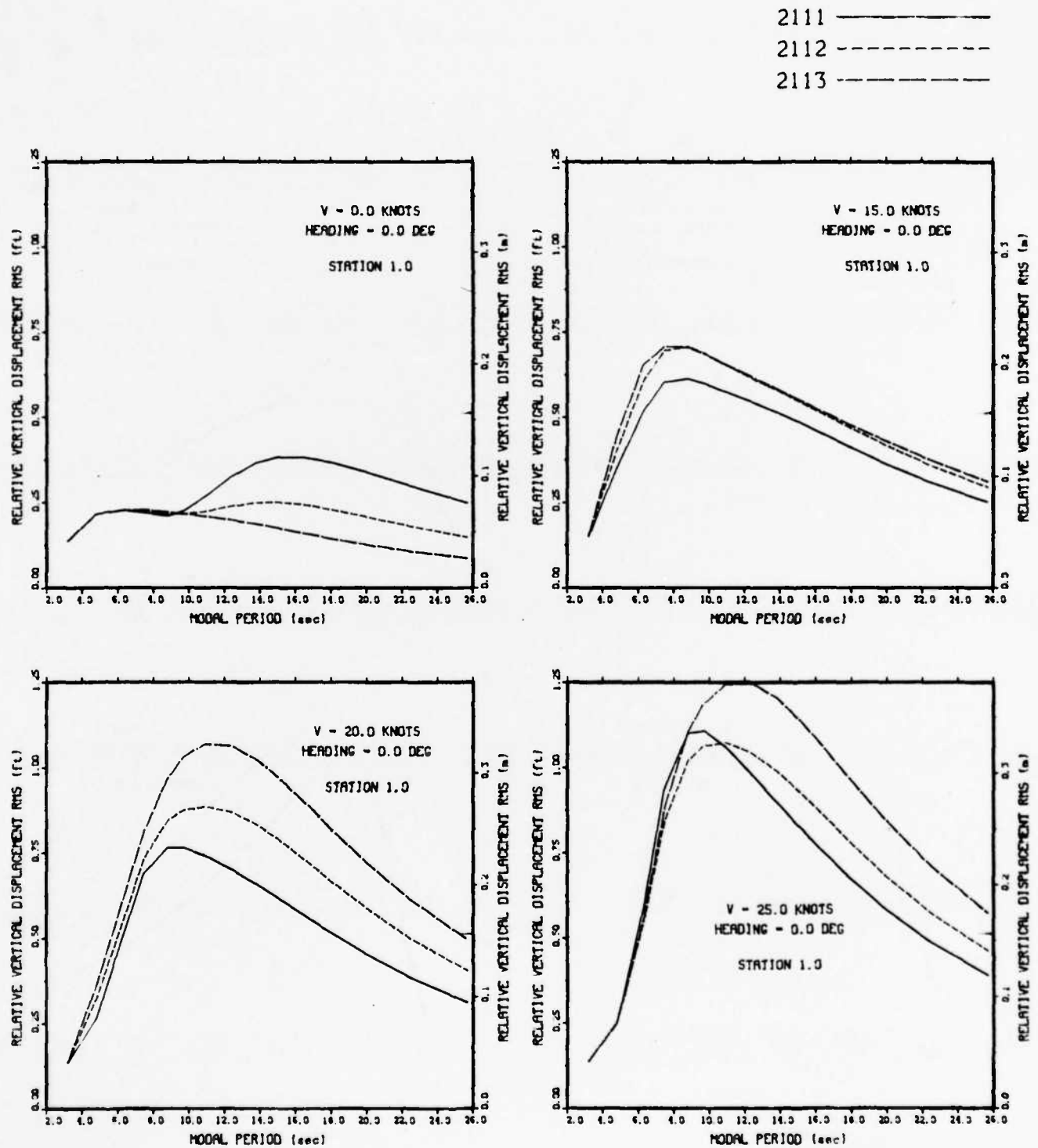


Figure 8j - Responses for Configurations 2111, 2112, and 2113

FIGURE 8 - CONTINUED

2121 - - - - -
2122 - - - - -
2123 - - - - -

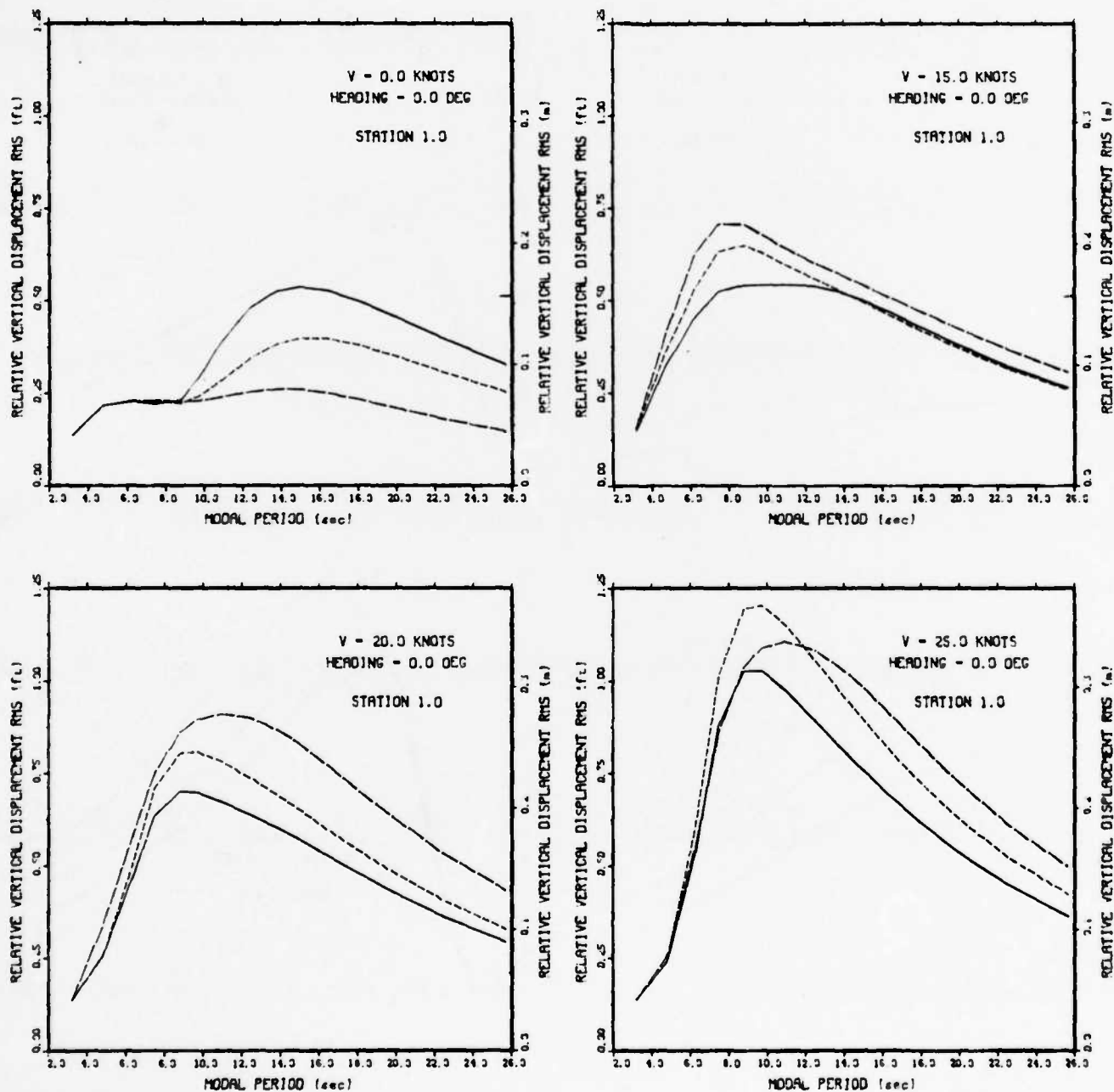


Figure 8k - Responses for Configurations 2121, 2122, and 2123

FIGURE 8 - CONTINUED

2132 -----
2133 - - - - -

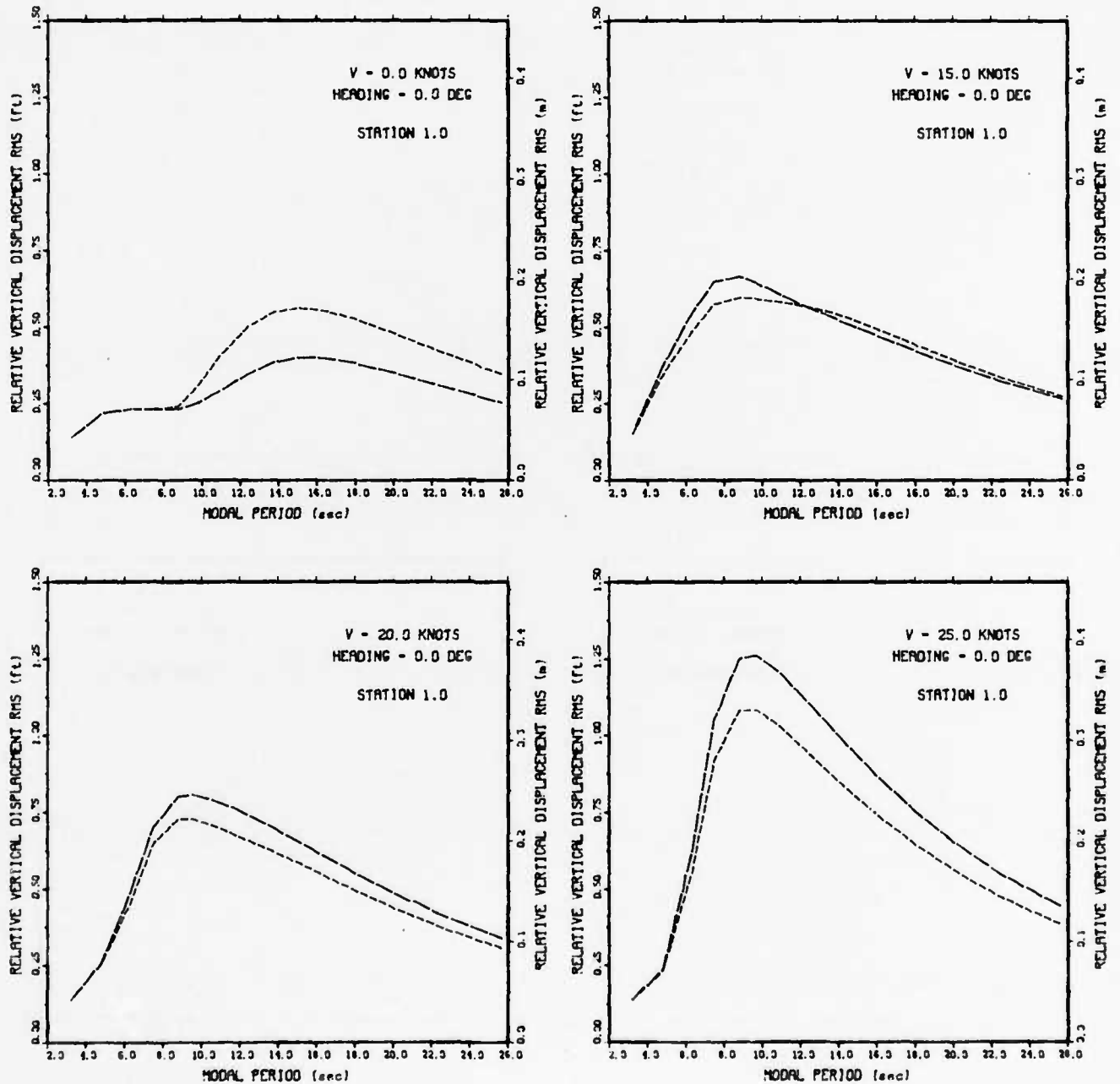


Figure 81 - Responses for Configurations 2132 and 2133

FIGURE 8 - CONTINUED

2211 —————
 2212 - - - - -
 2213 - - - - -

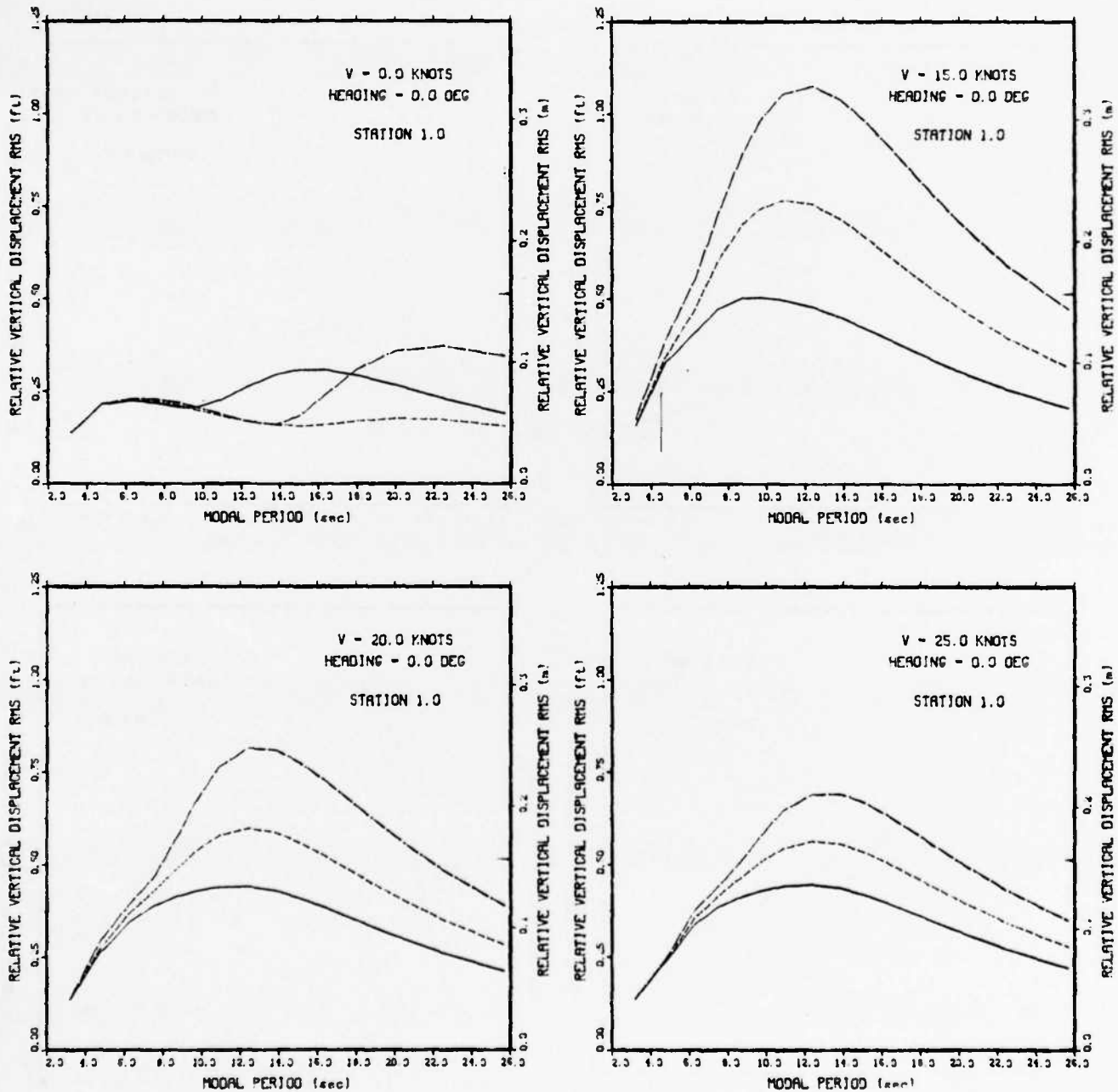


Figure 8m - Responses for Configurations 2211, 2212, and 2213

FIGURE 8 - CONTINUED

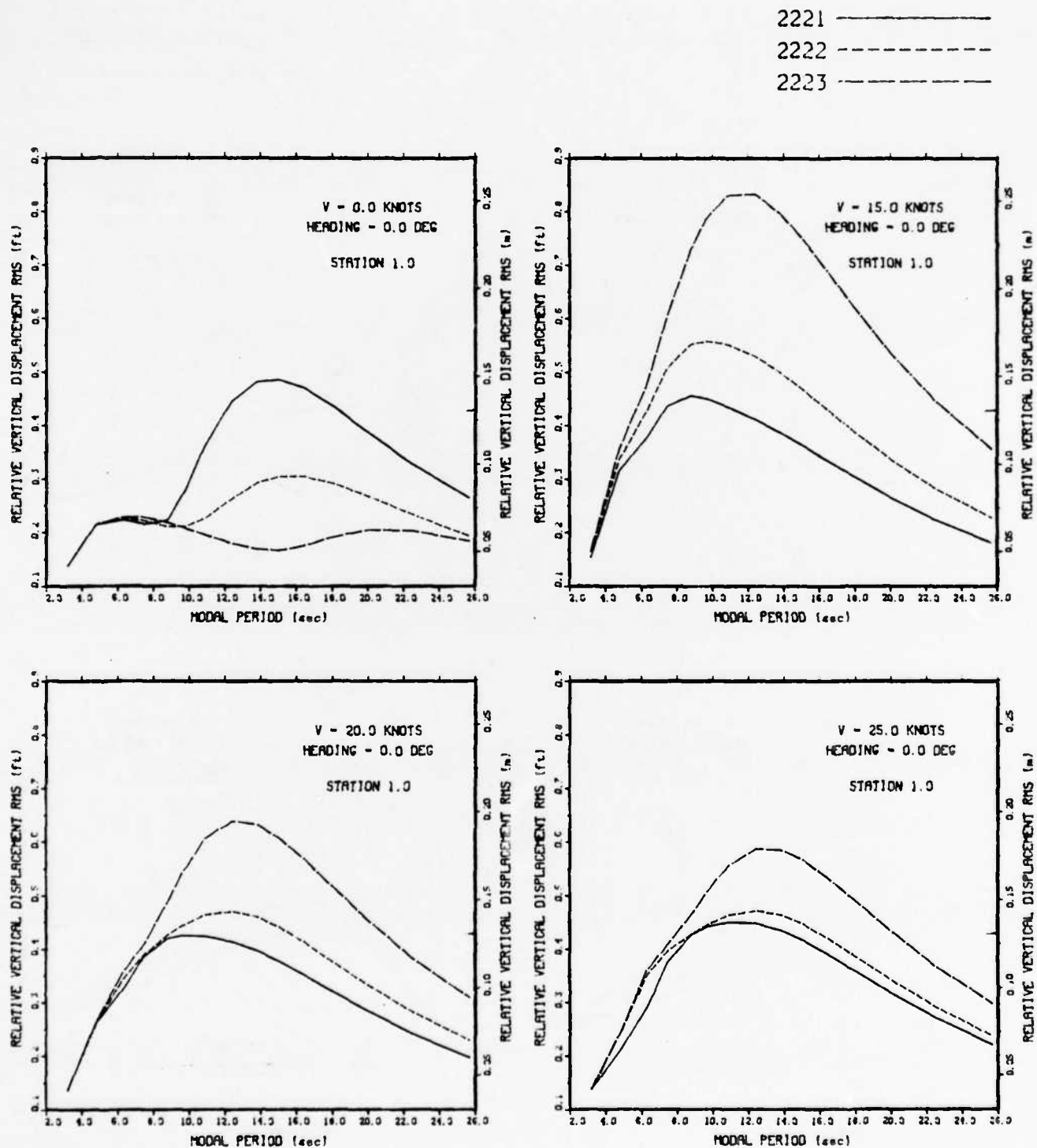


Figure 8n - Responses for Configurations 2221, 2222, and 2223

FIGURE 8 - CONTINUED

2231 —————
 2232 - - - - -
 2233 - - - - -

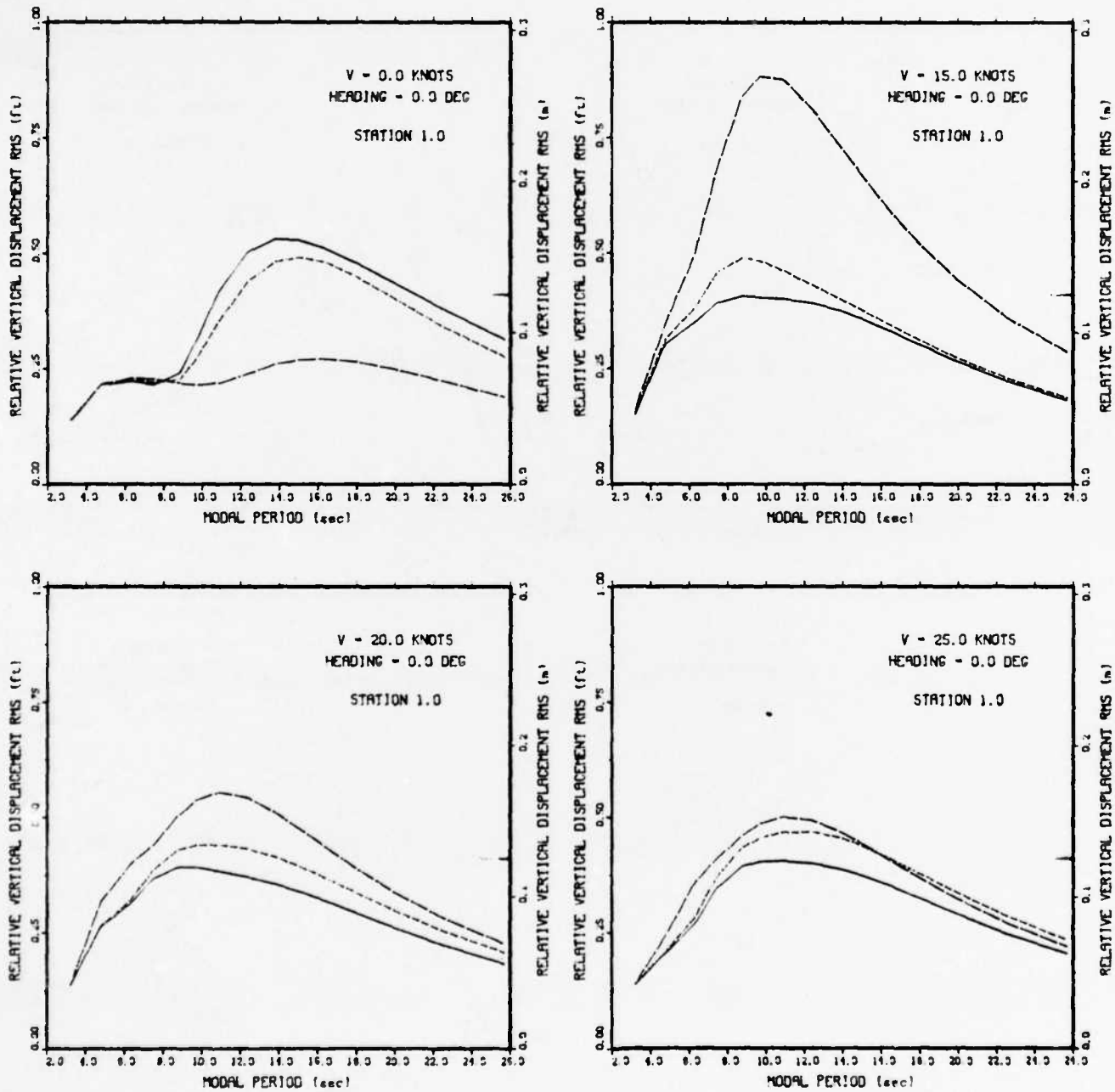


Figure 8a - Responses for Configurations 2231, 2232, and 2233

FIGURE 8 - CONTINUED

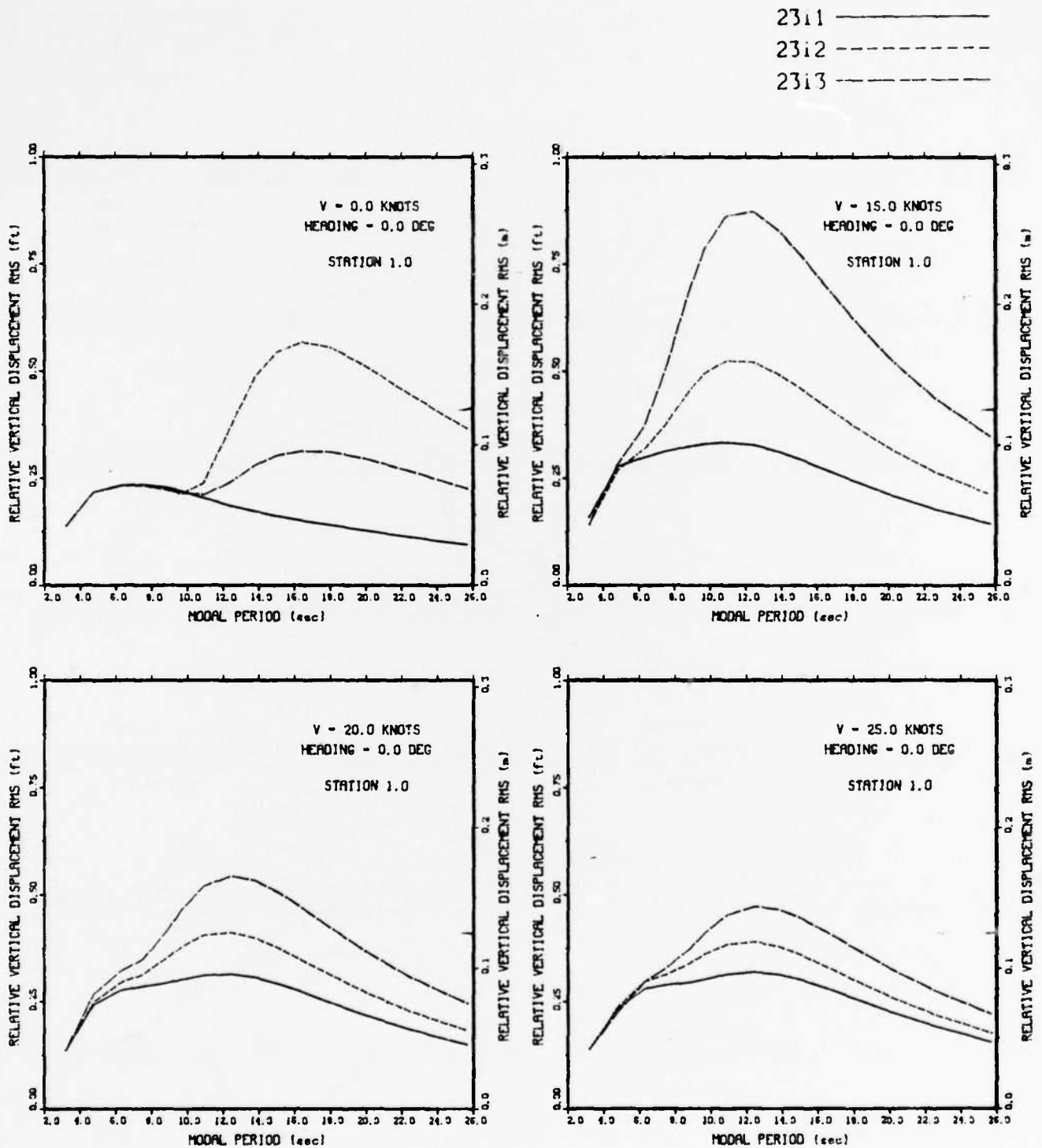


Figure 8p - Responses for Configurations 2311, 2312, and 2313

FIGURE 8 - CONTINUED

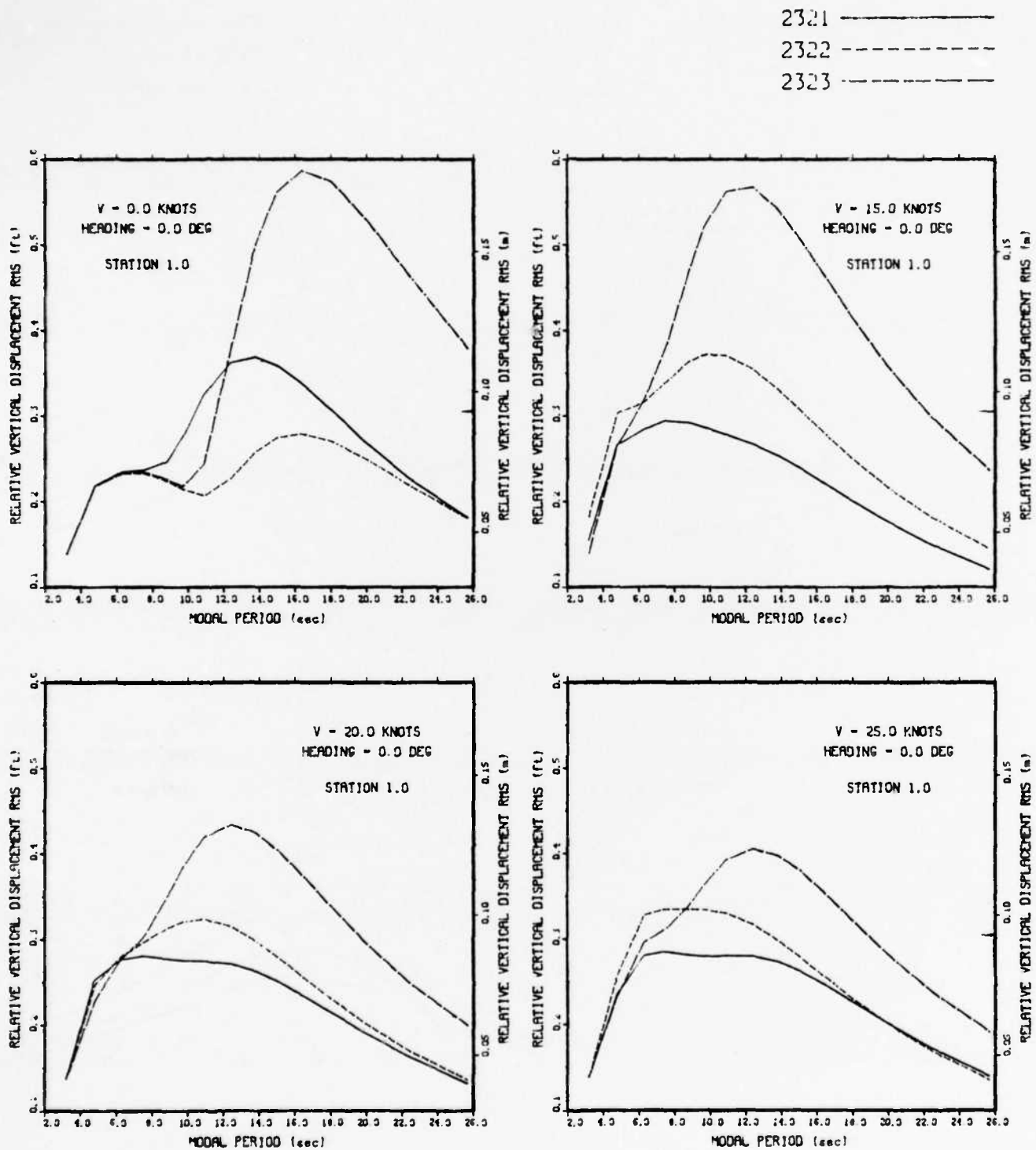


Figure 8q - Responses for Configurations 2321, 2322, and 2323

FIGURE 8 - CONTINUED

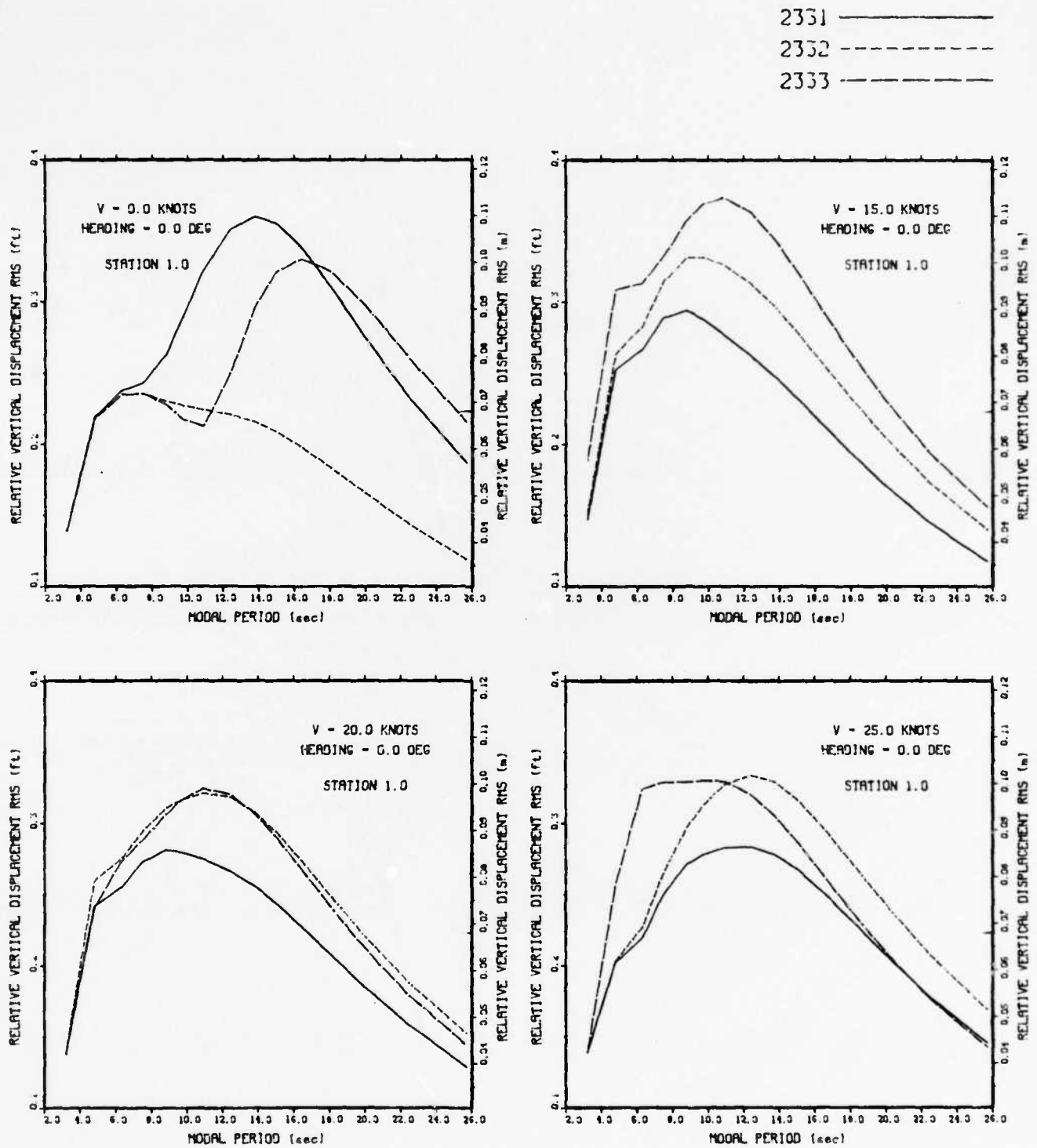


Figure 8r - Responses for Configurations 2331, 2332, and 2333

FIGURE 8 - CONTINUED

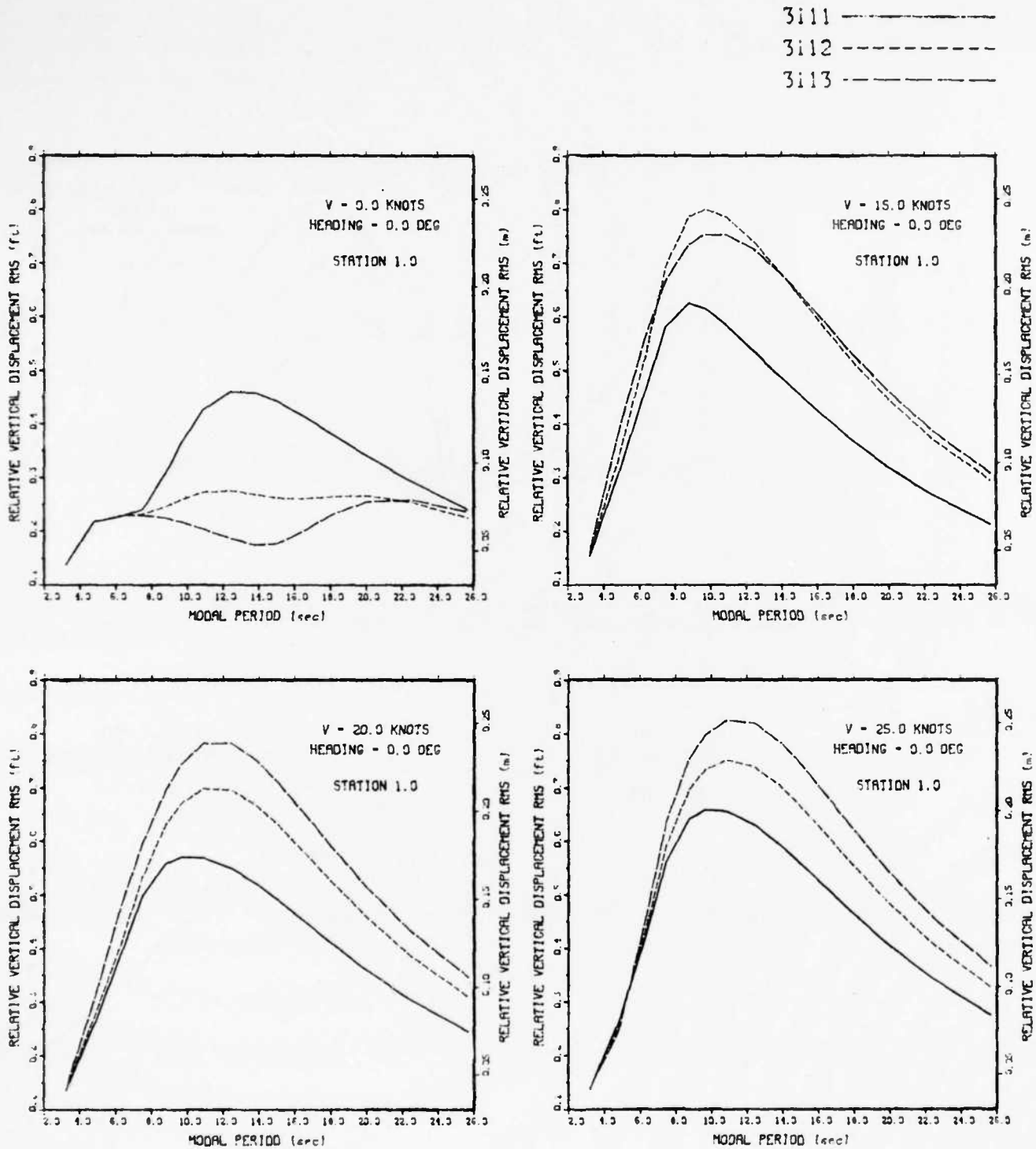


Figure 8s - Responses for Configurations 3111, 3112, and 3113

FIGURE 8 - CONTINUED

3121 —————
 3122 - - - - -
 3123 - · - · - ·

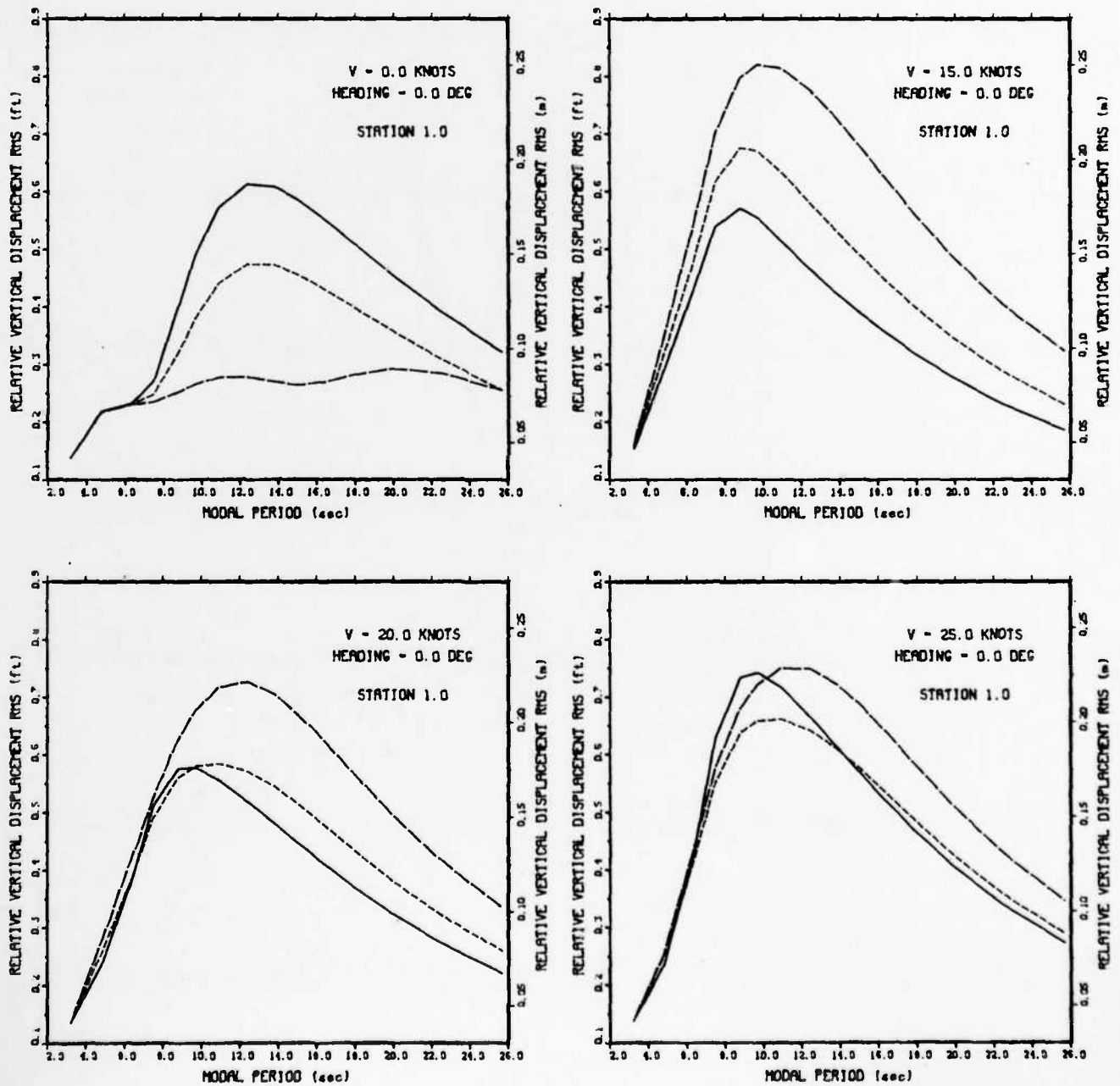


Figure 8t - Responses for Configurations 3121, 3122, and 3123

FIGURE 8 - CONTINUED

3132 -----
3133 - - - - -

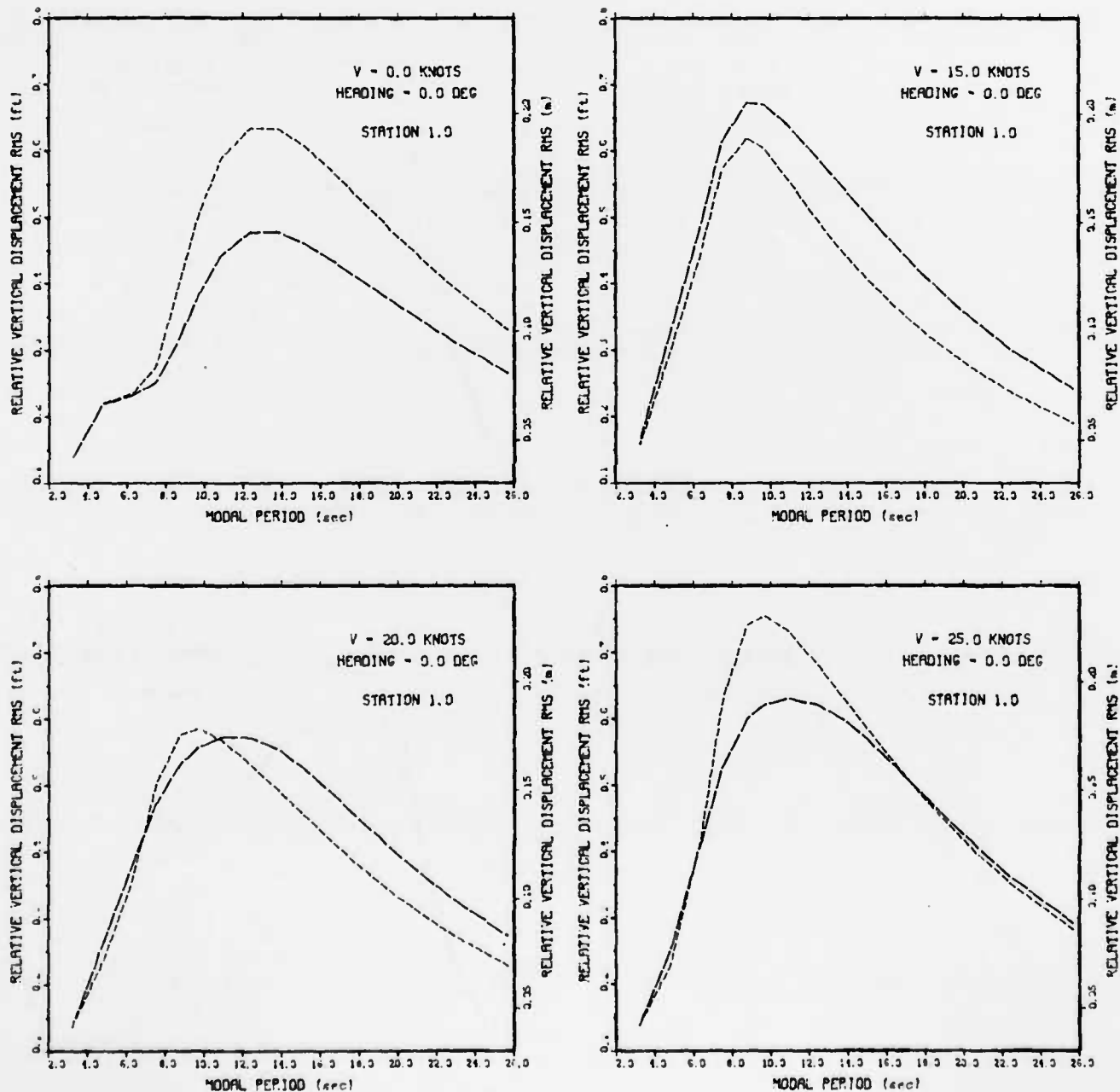


Figure 8u - Responses for Configurations 3132 and 3133

FIGURE 8 - CONTINUED

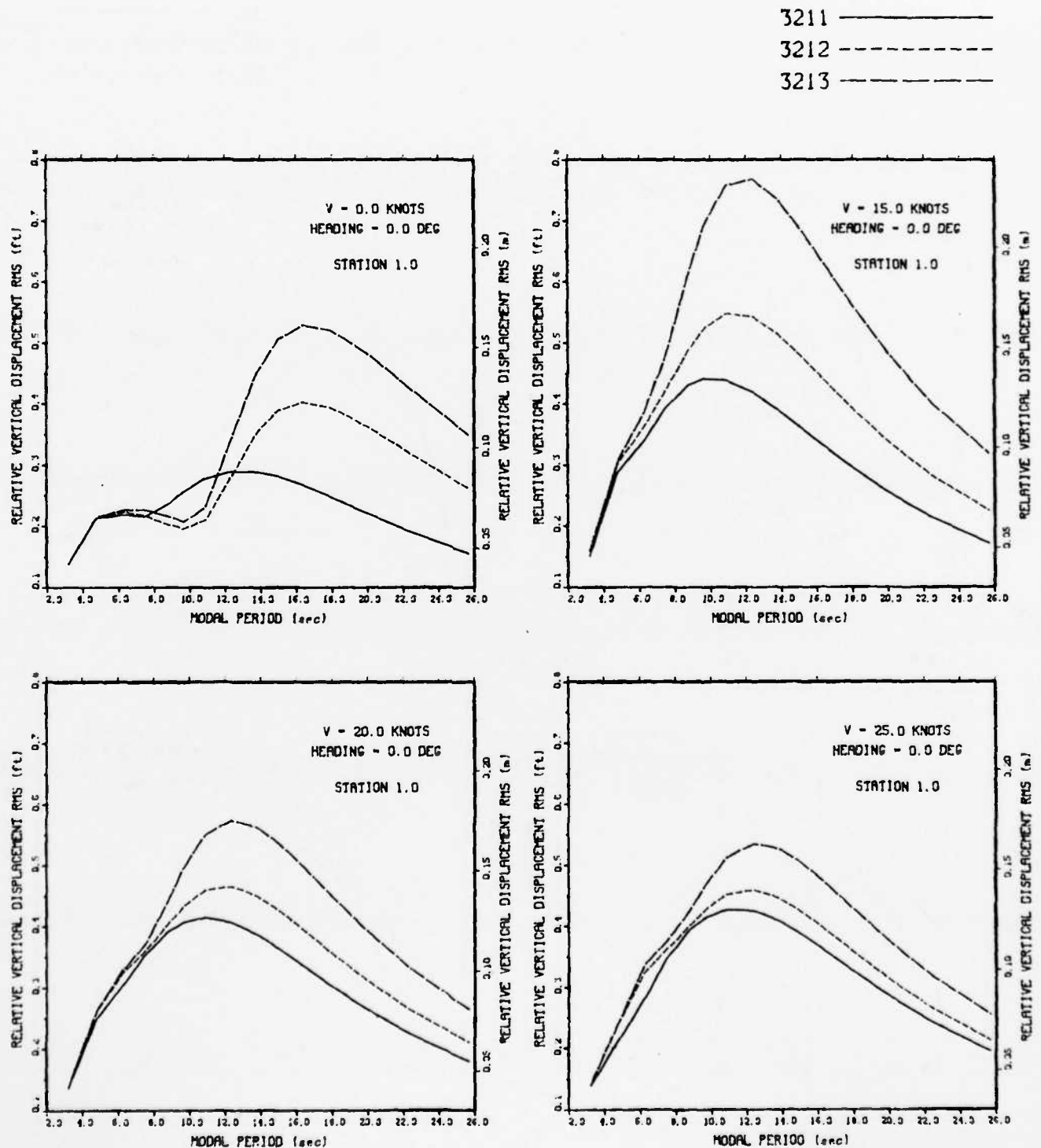


Figure 8v - Responses for Configurations 3211, 3212, and 3213

FIGURE 8 - CONTINUED

3221 —————
 3222 - - - - -
 3223 - - - - -

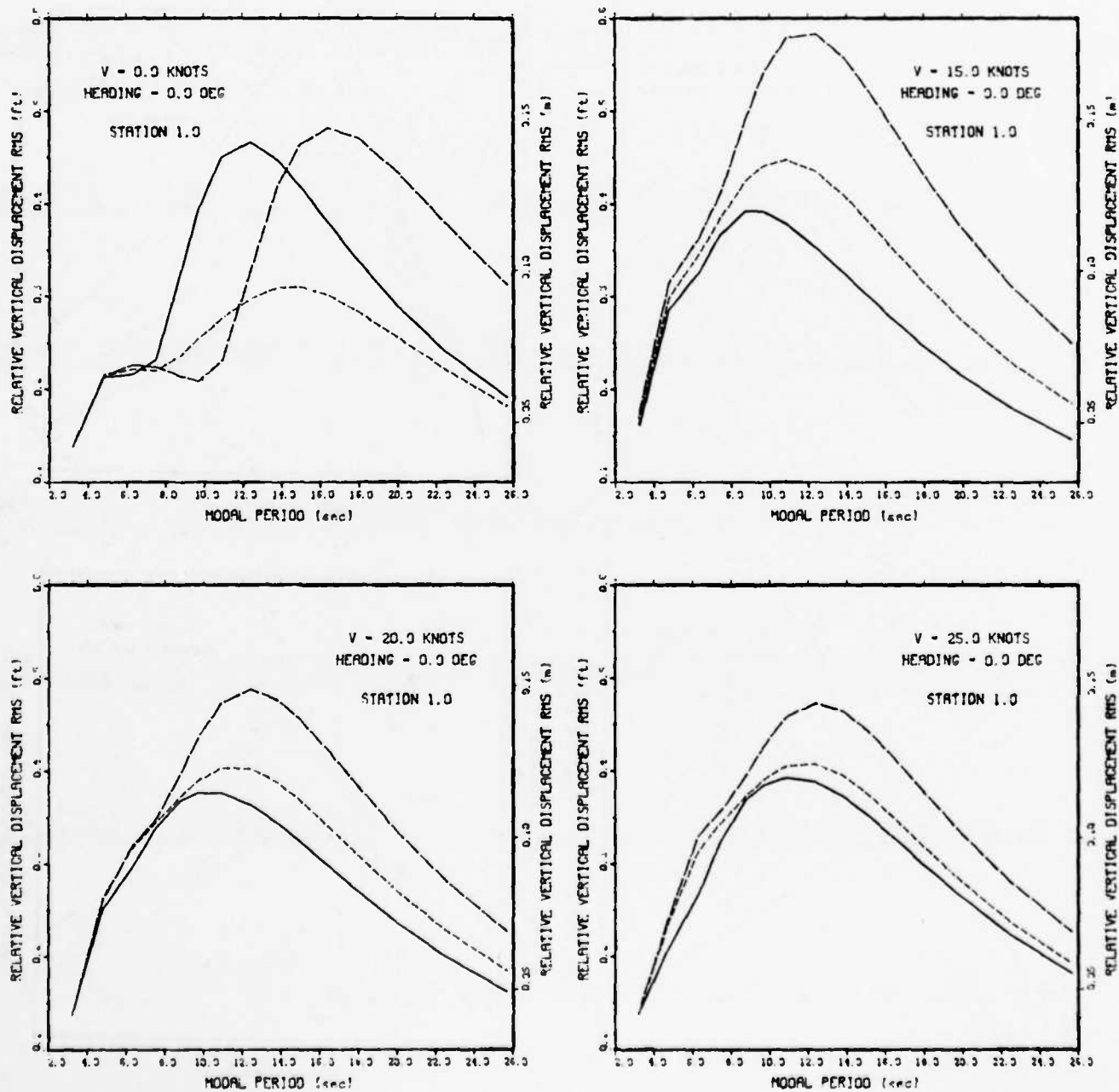


Figure 8w - Responses for Configurations 3221, 3222, and 3223

FIGURE 8 - CONTINUED

3231 —————
 3232 - - - - -
 3233 -

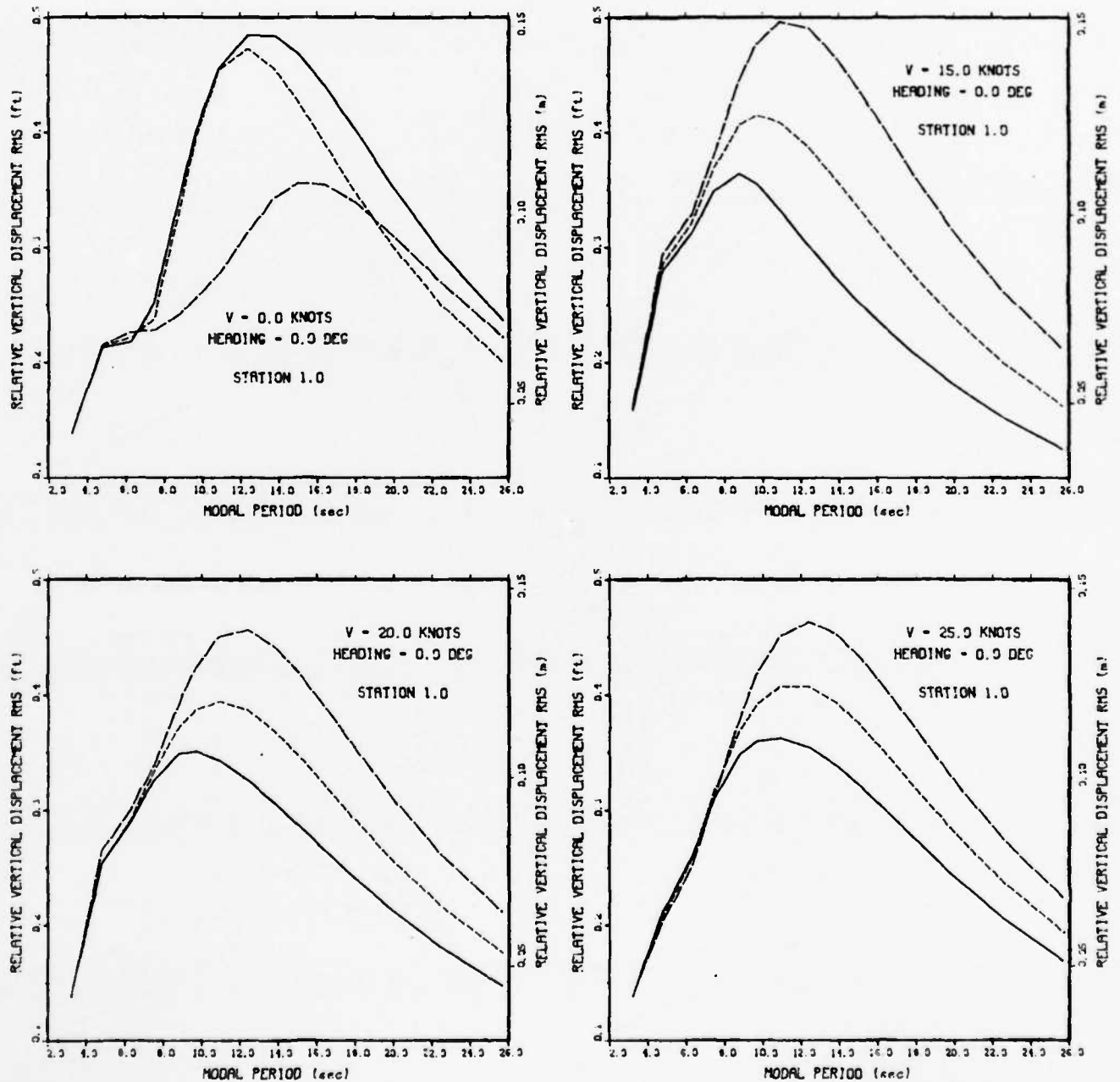


Figure 8x - Responses for Configurations 3231, 3232, and 3233

FIGURE 8 - CONTINUED

3311 ———
3312 - - -
3313 - - -

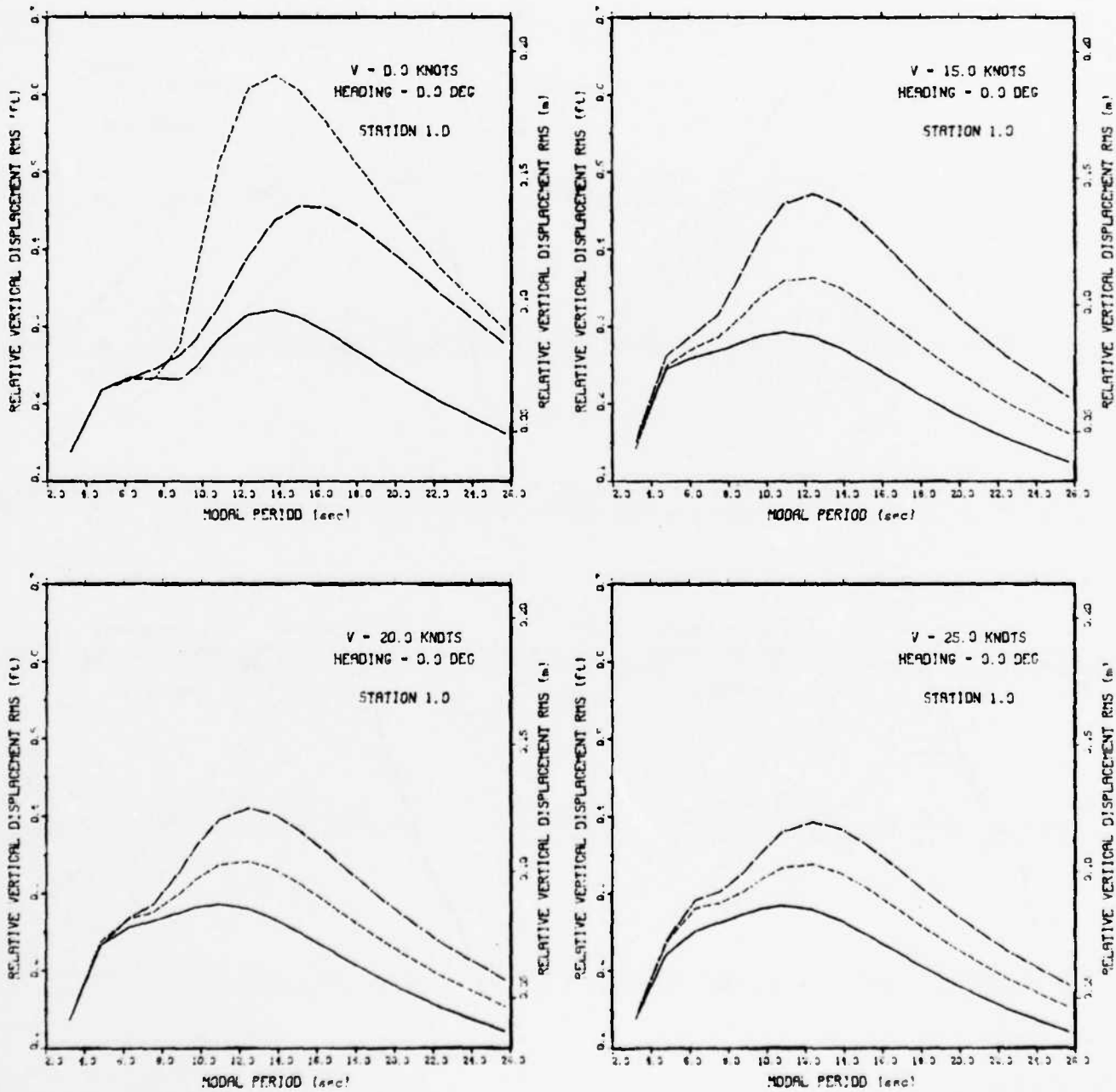


Figure 8y - Responses for Configurations 3311, 3312, and 3313

FIGURE 8 - CONTINUED

3321 —————
 3322 - - - - -
 3323 —————

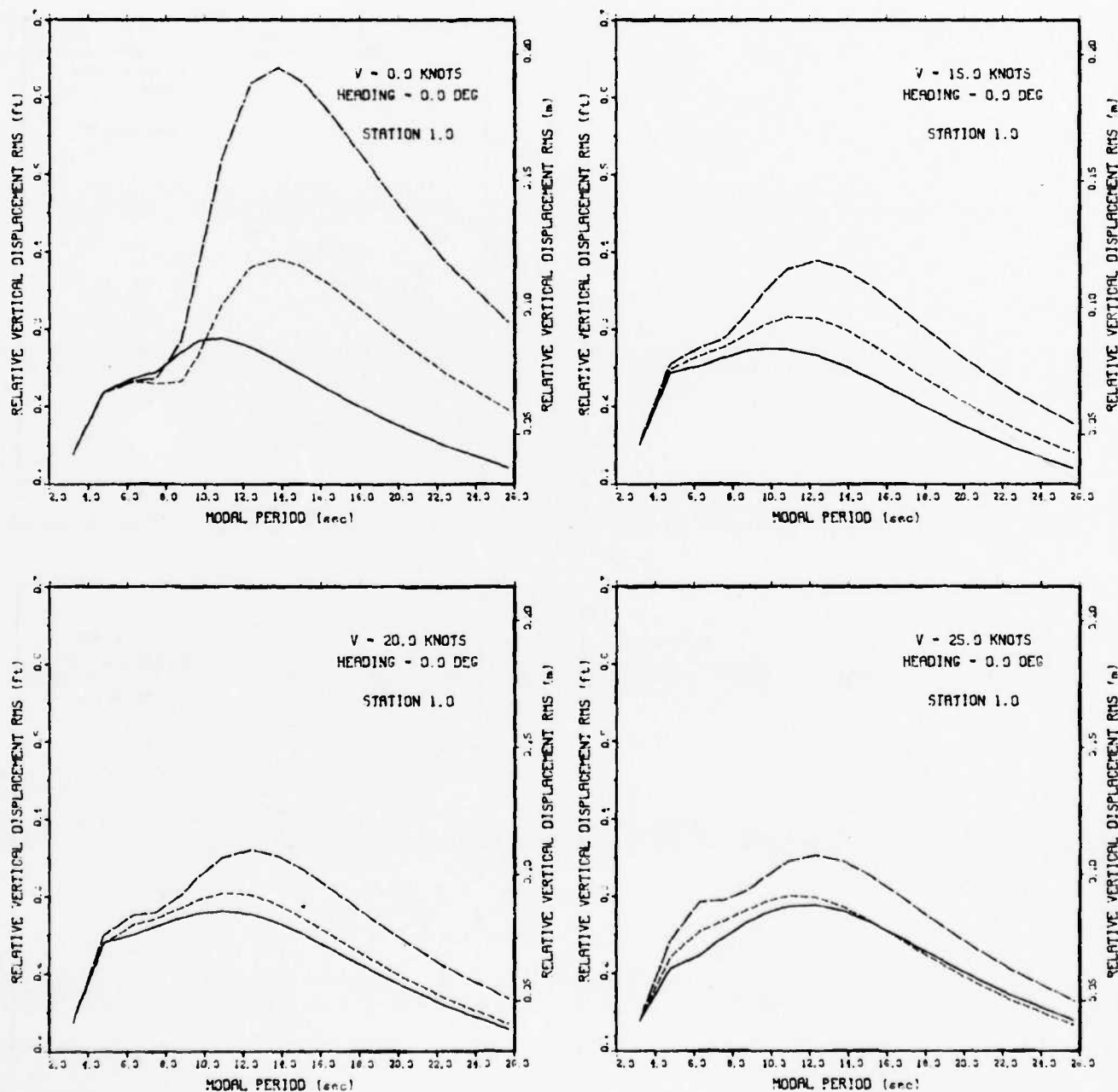


Figure 8z - Responses for Configurations 3321, 3322, and 3323

FIGURE 8 - CONTINUED

3331 —————
 3332 - - - - -
 3333 - - - - -

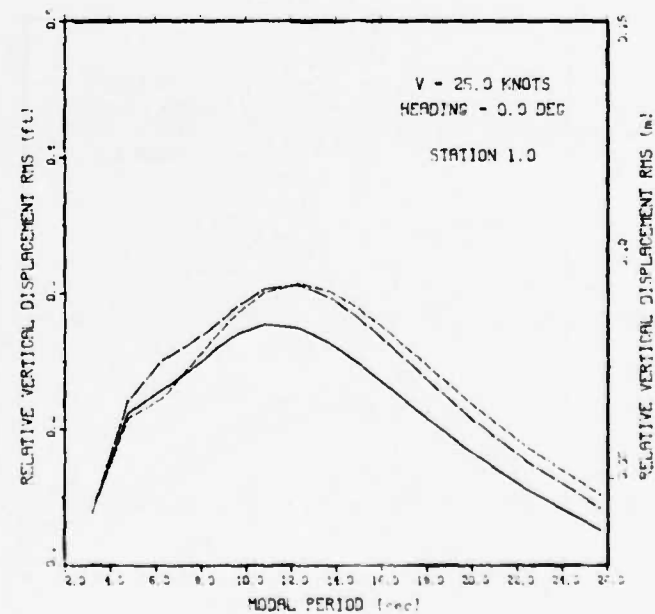
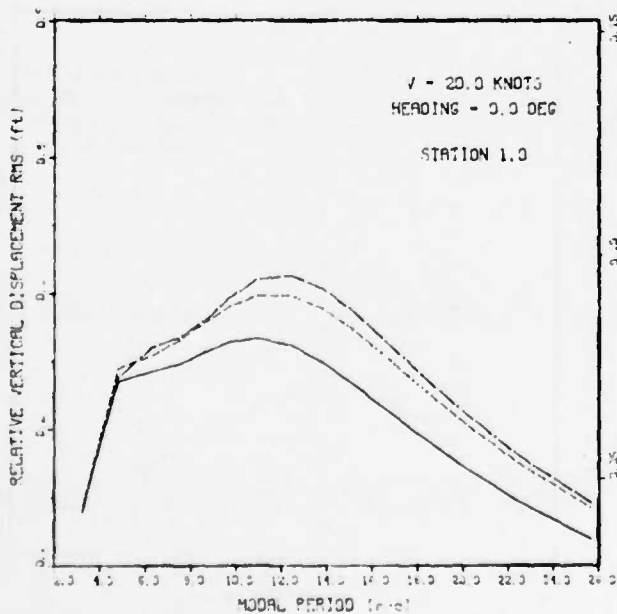
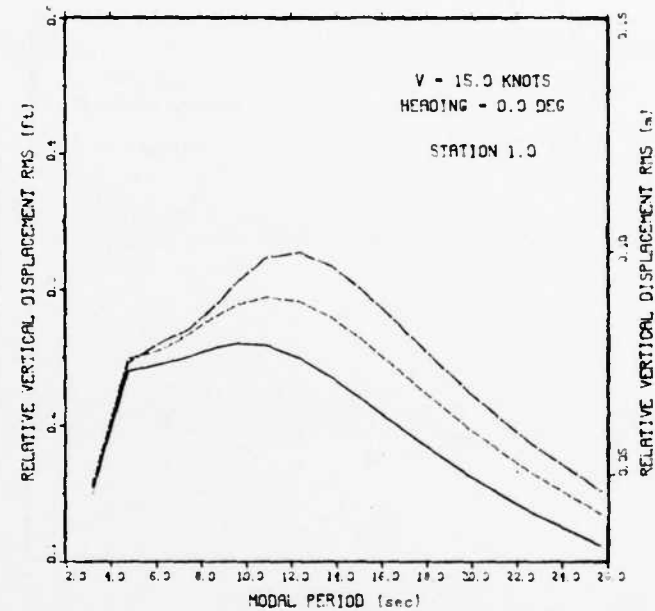
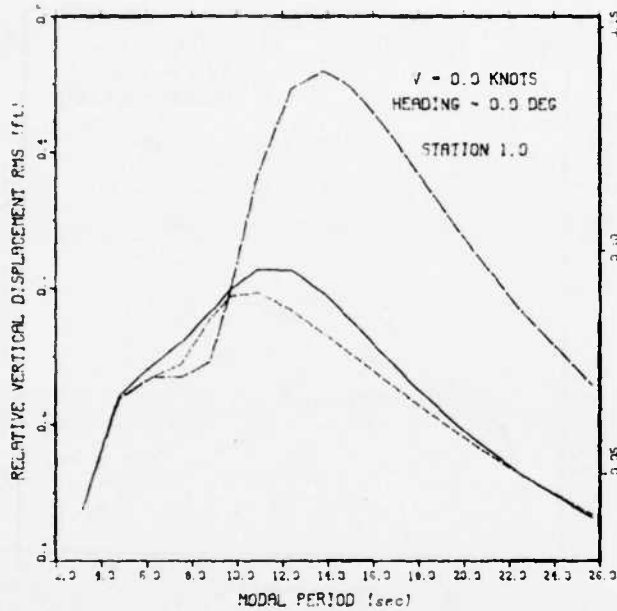


Figure 8aa - Responses for Configurations 3331, 3332, and 3333

FIGURE 9 - ABSOLUTE STERN MOTION RMS RESPONSES IN FOLLOWING SEAS

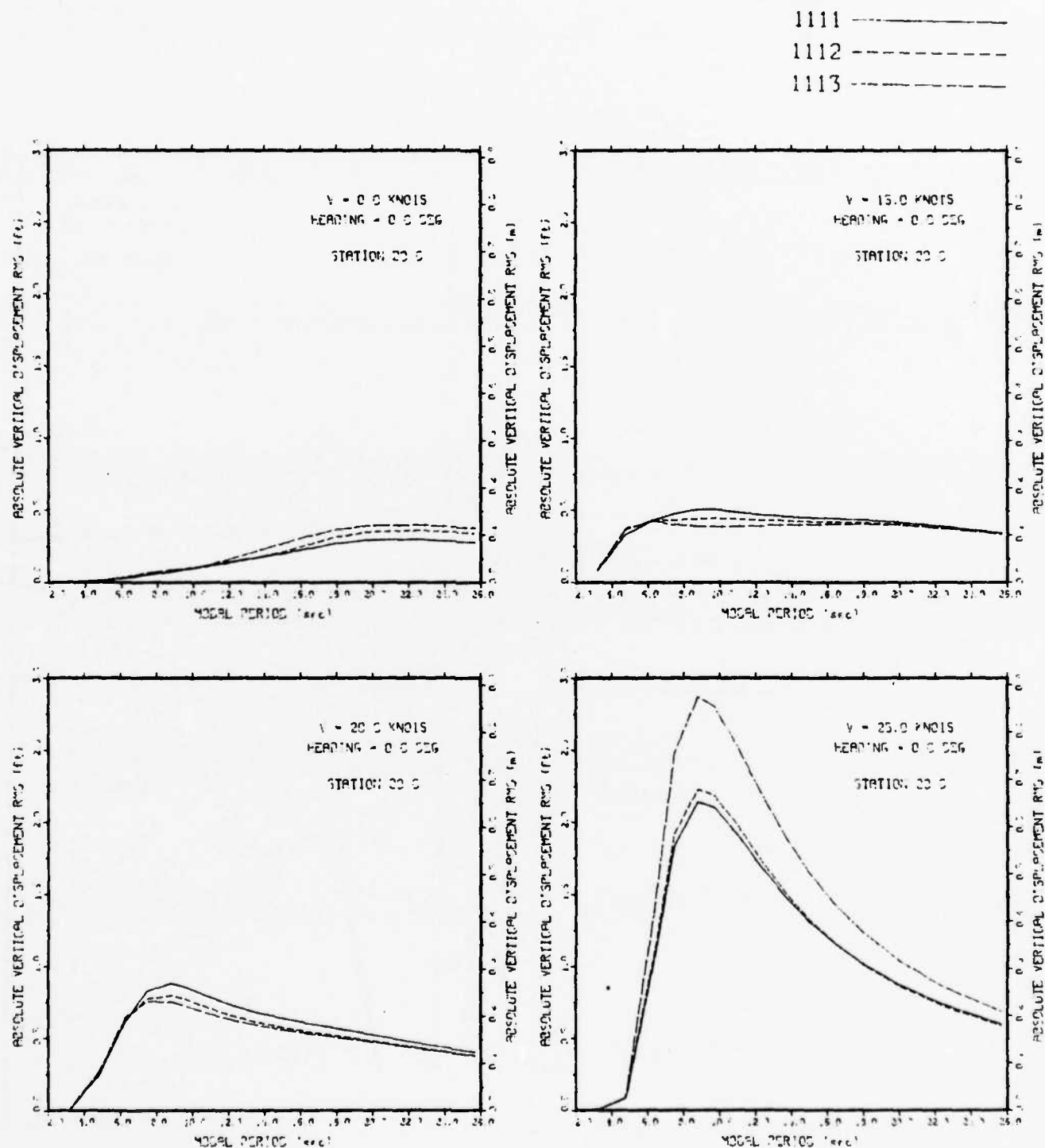


Figure 9a - Responses for Configurations 1111, 1112, and 1113

FIGURE 9 - CONTINUED

1121 —————
 1122 - - - - -
 1123 - - - - -

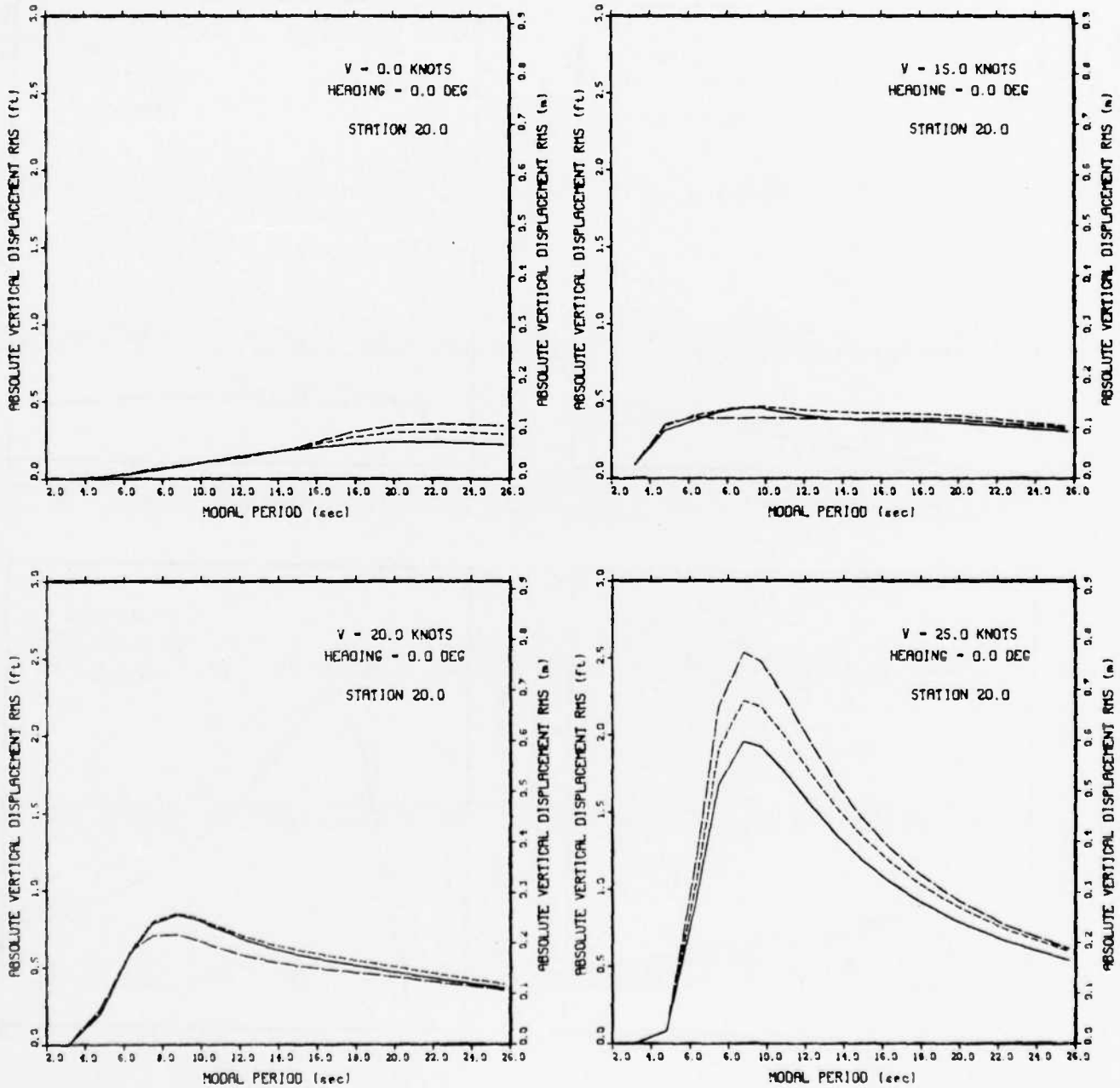


Figure 9b - Responses for Configurations 1121, 1122, and 1123

FIGURE 9 - CONTINUED

1131 —————
 1132 - - - - -
 1133 ————

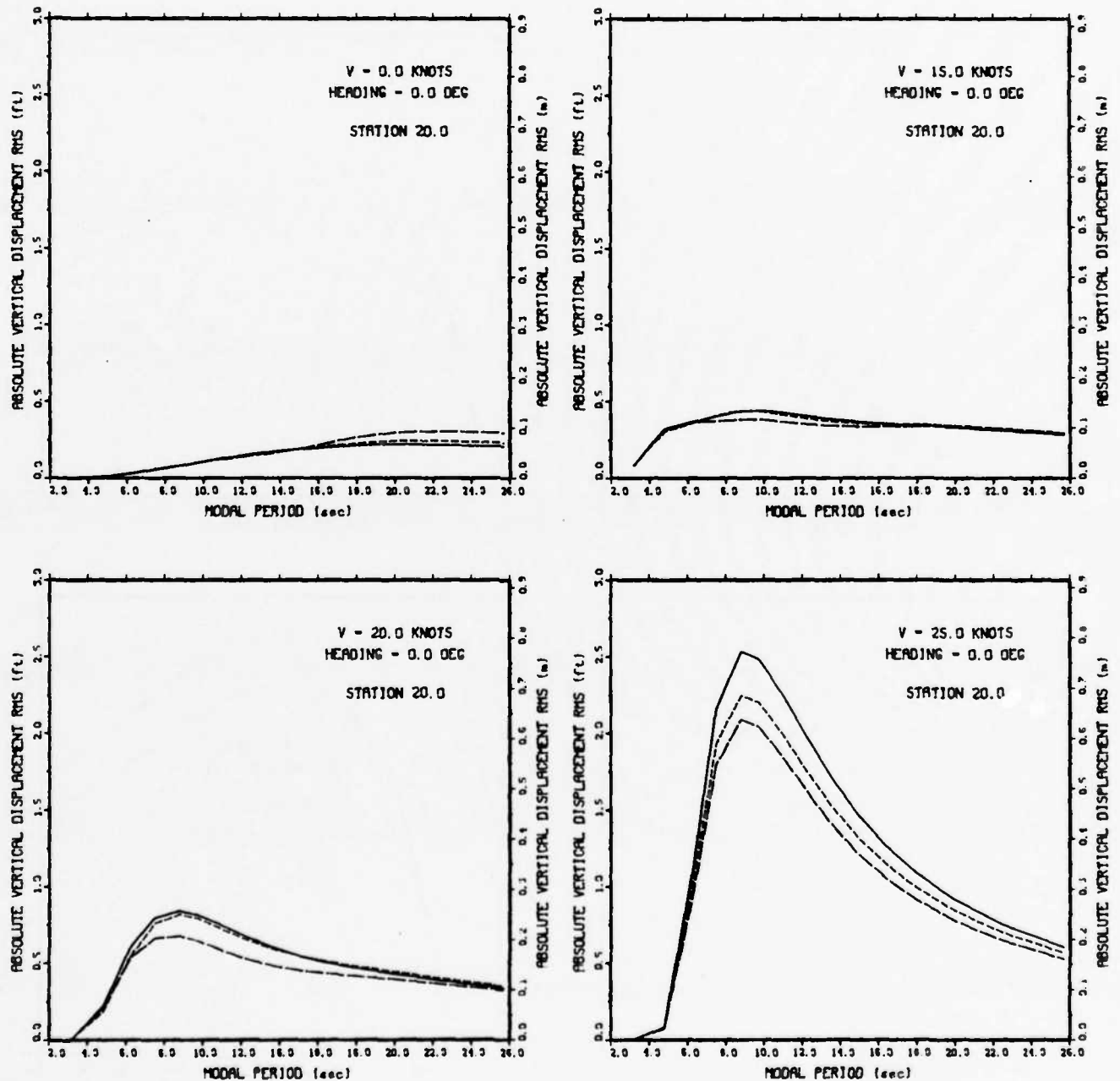


Figure 9c - Responses for Configurations 1131, 1132, and 1133

FIGURE 9 - CONTINUED

1211 —————
 1212 - - - - -
 1213 - - - - -

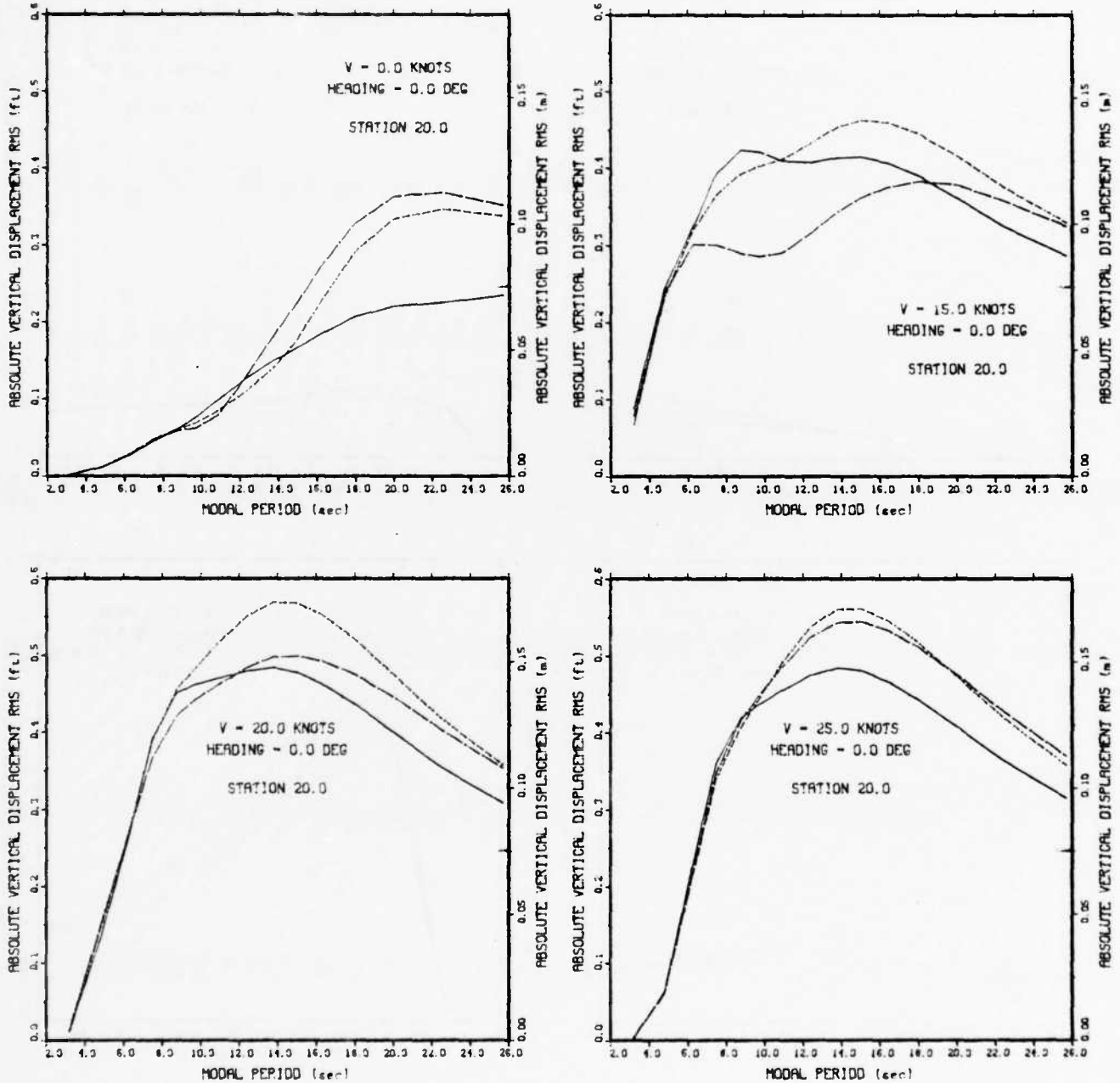


Figure 9d - Responses for Configurations 1211, 1212, and 1213

FIGURE 9 - CONTINUED

1221 —————
 1222 - - - - -
 1223 - - - - -

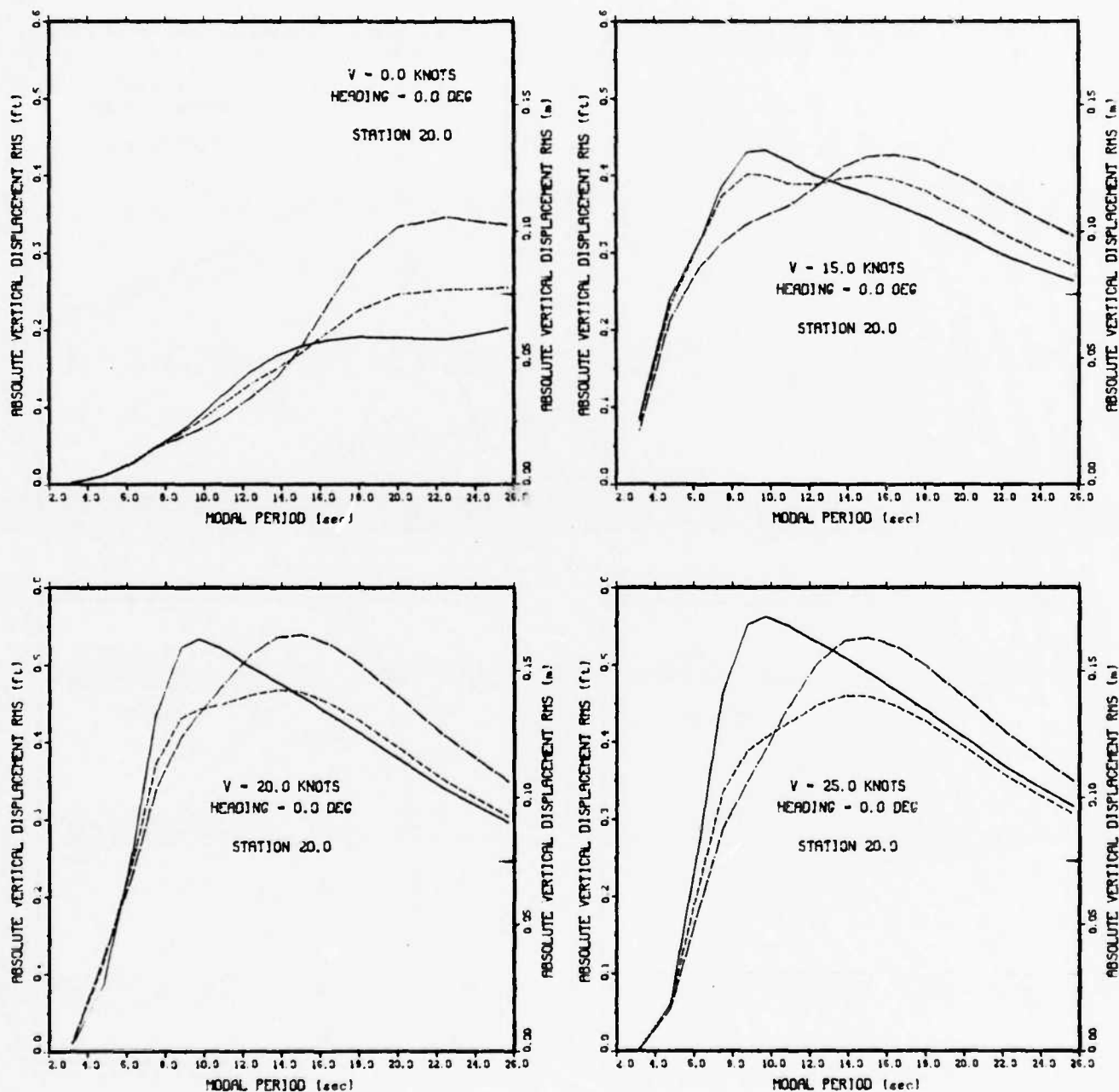


Figure 9e - Responses for Configurations 1221, 1222, and 1223

FIGURE 9 - CONTINUED

1231 —————
1232 - - - - -
1233 - - - - -

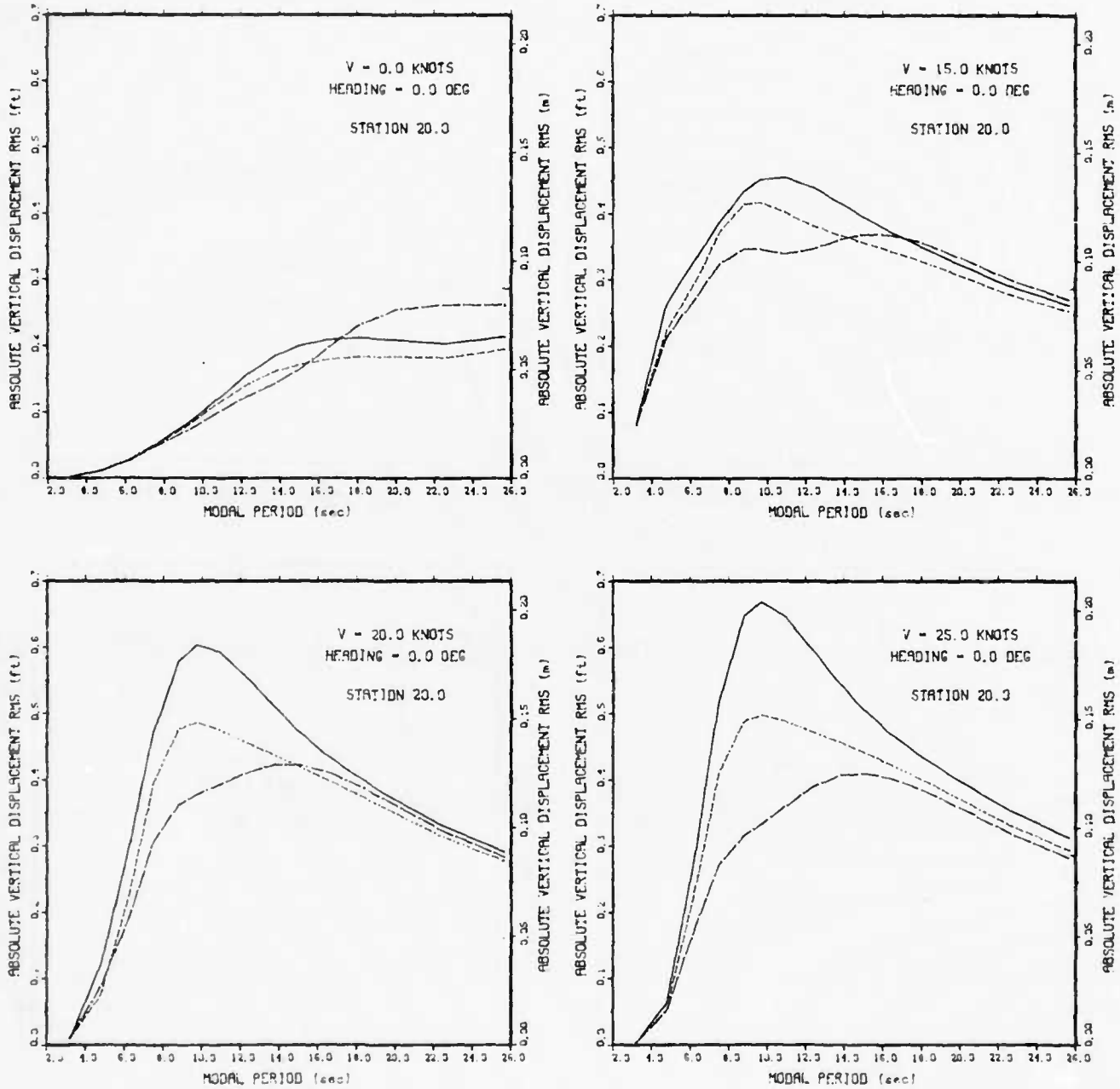


Figure 9f - Responses for Configurations 1231, 1232, and 1233

FIGURE 9 - CONTINUED

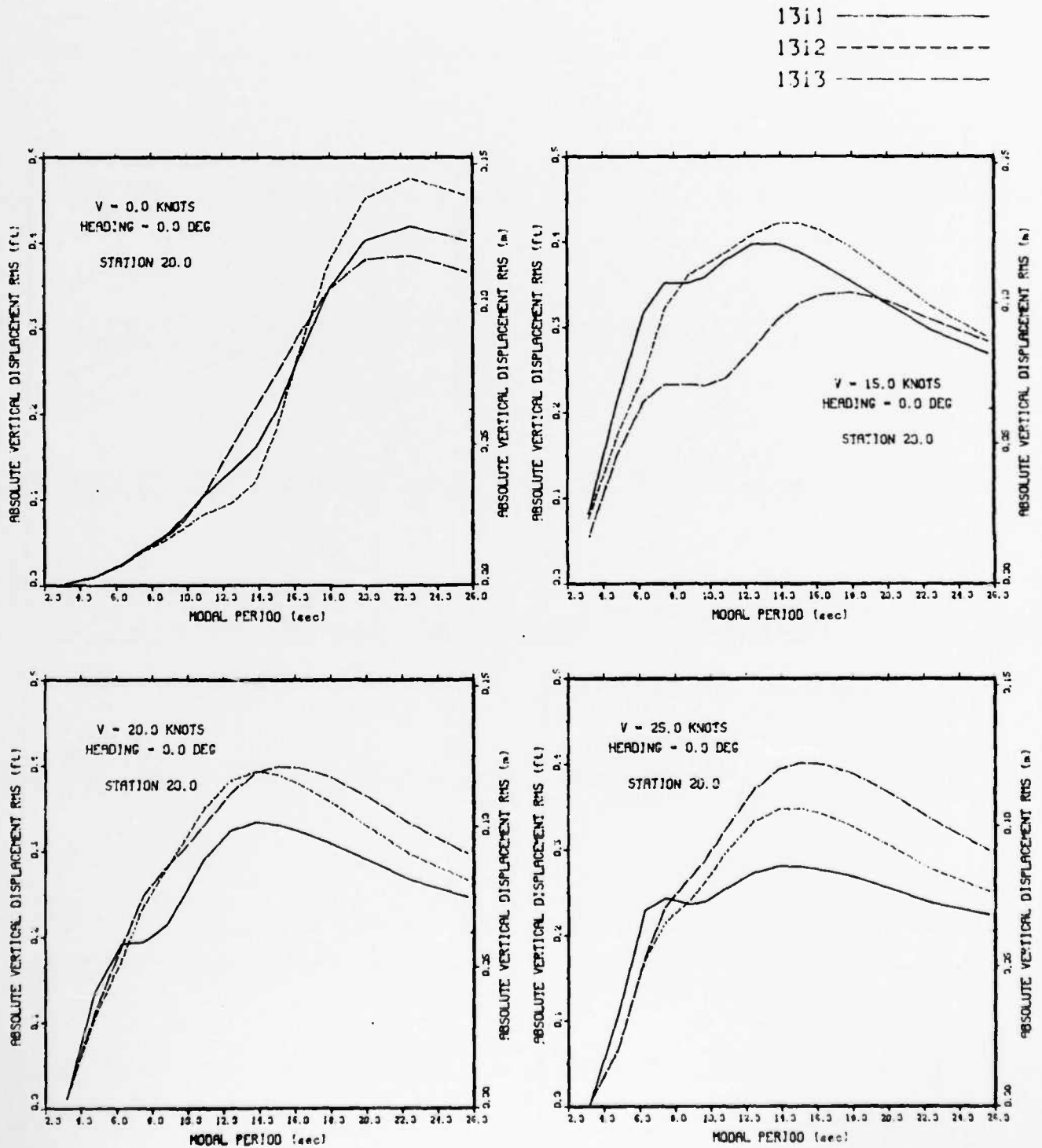


Figure 9g - Responses for Configurations 1311, 1312, and 1313

FIGURE 9 - CONTINUED

1321 —————
1322 - - - - -
1323

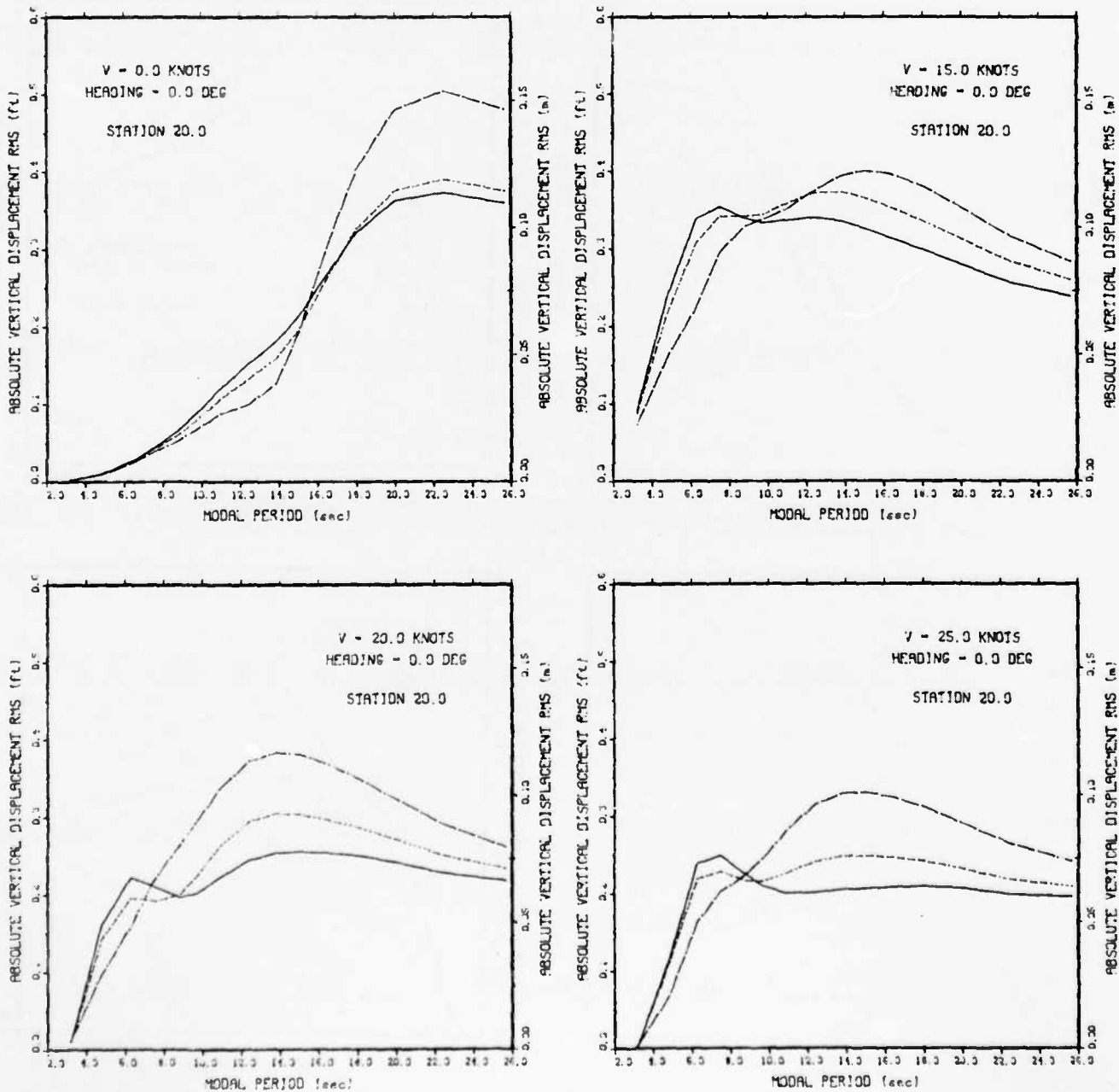


Figure 9h - Responses for Configurations 1321, 1322, and 1323

FIGURE 9 - CONTINUED

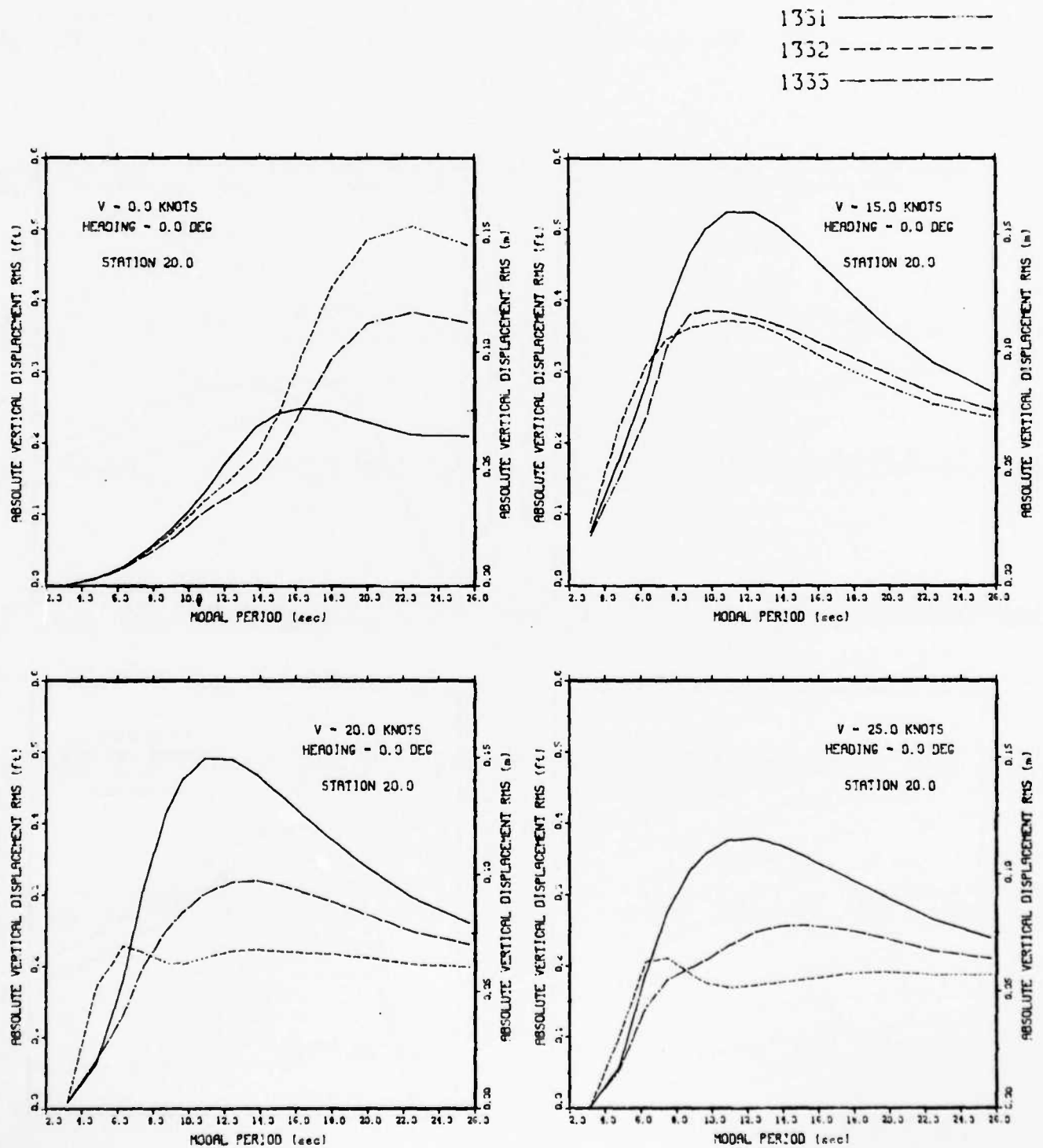


Figure 91 - Responses for Configurations 1331, 1332, and 1333

FIGURE 9 - CONTINUED

2111 —————
 2112 - - - - -
 2113 - - - - -

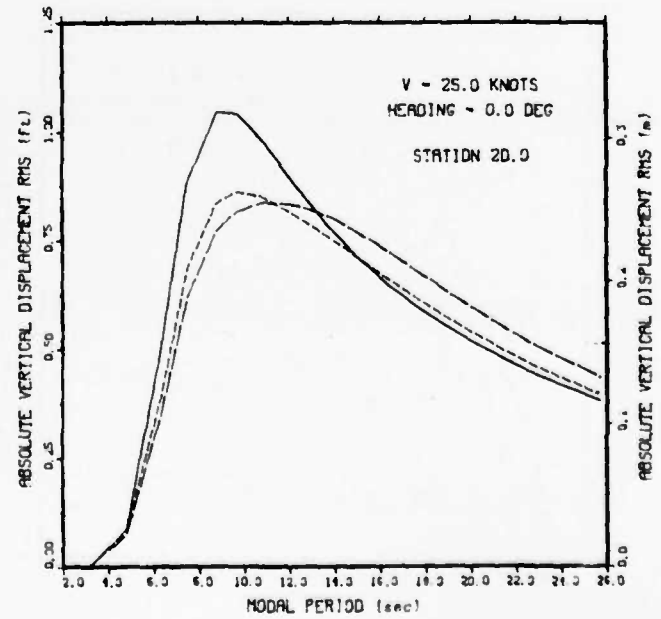
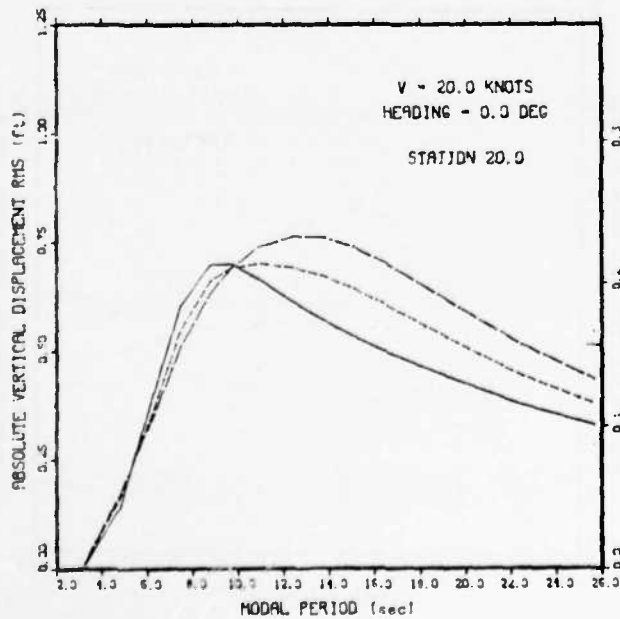
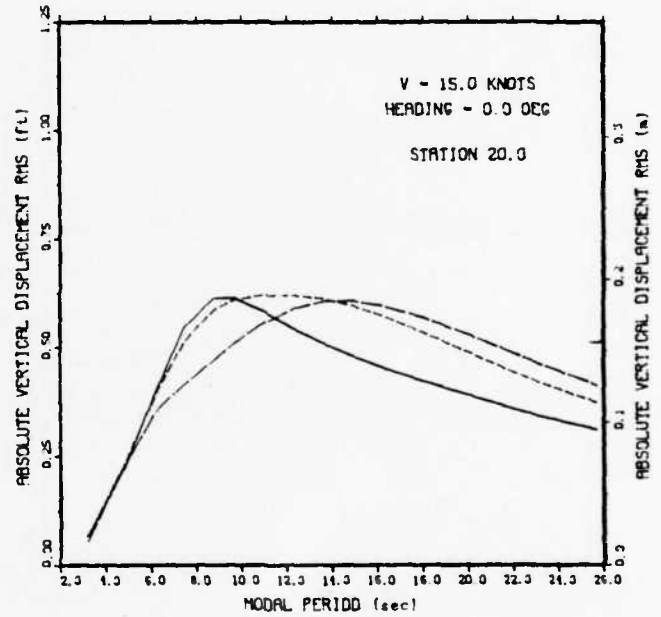
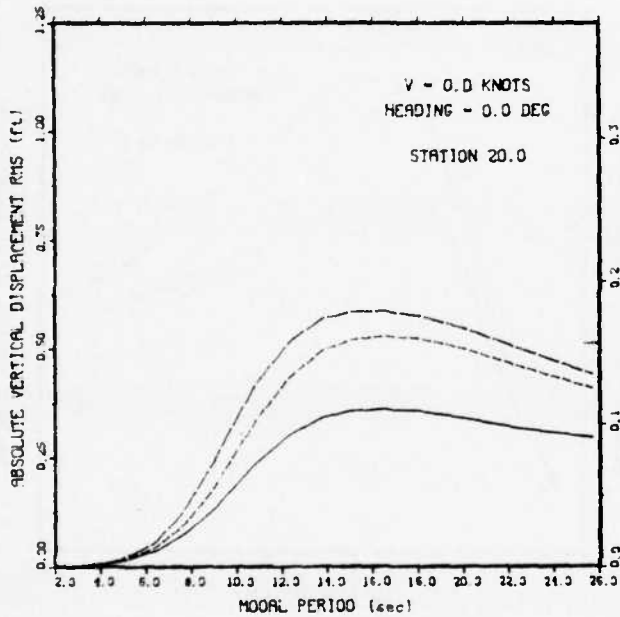


Figure 9j - Responses for Configurations 2111, 2112, and 2113

FIGURE 9 - CONTINUED

2121 ———
2122 - - - -
2123 - - - -

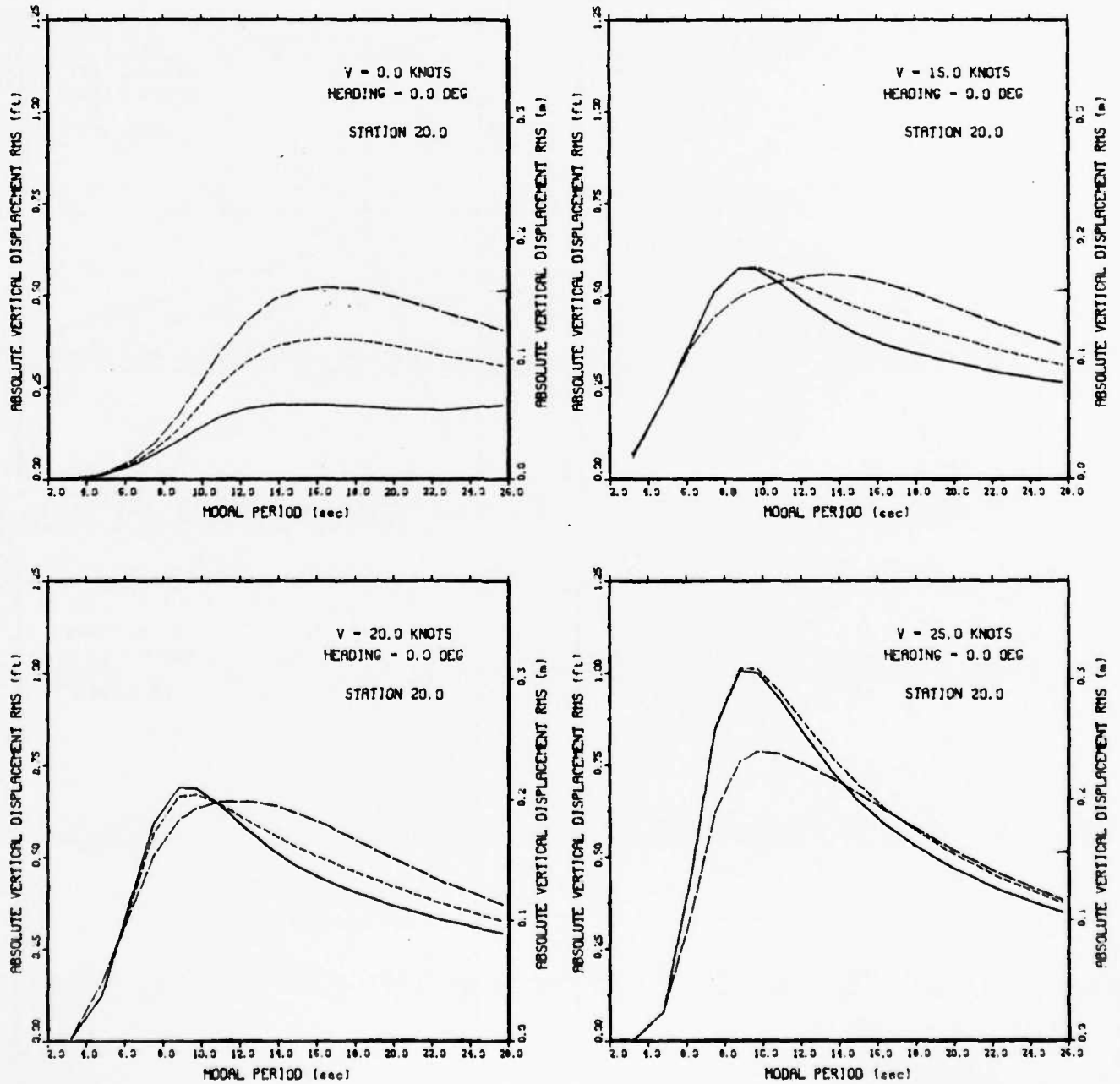


Figure 9k - Responses for Configurations 2121, 2122, and 2123

FIGURE 9 - CONTINUED

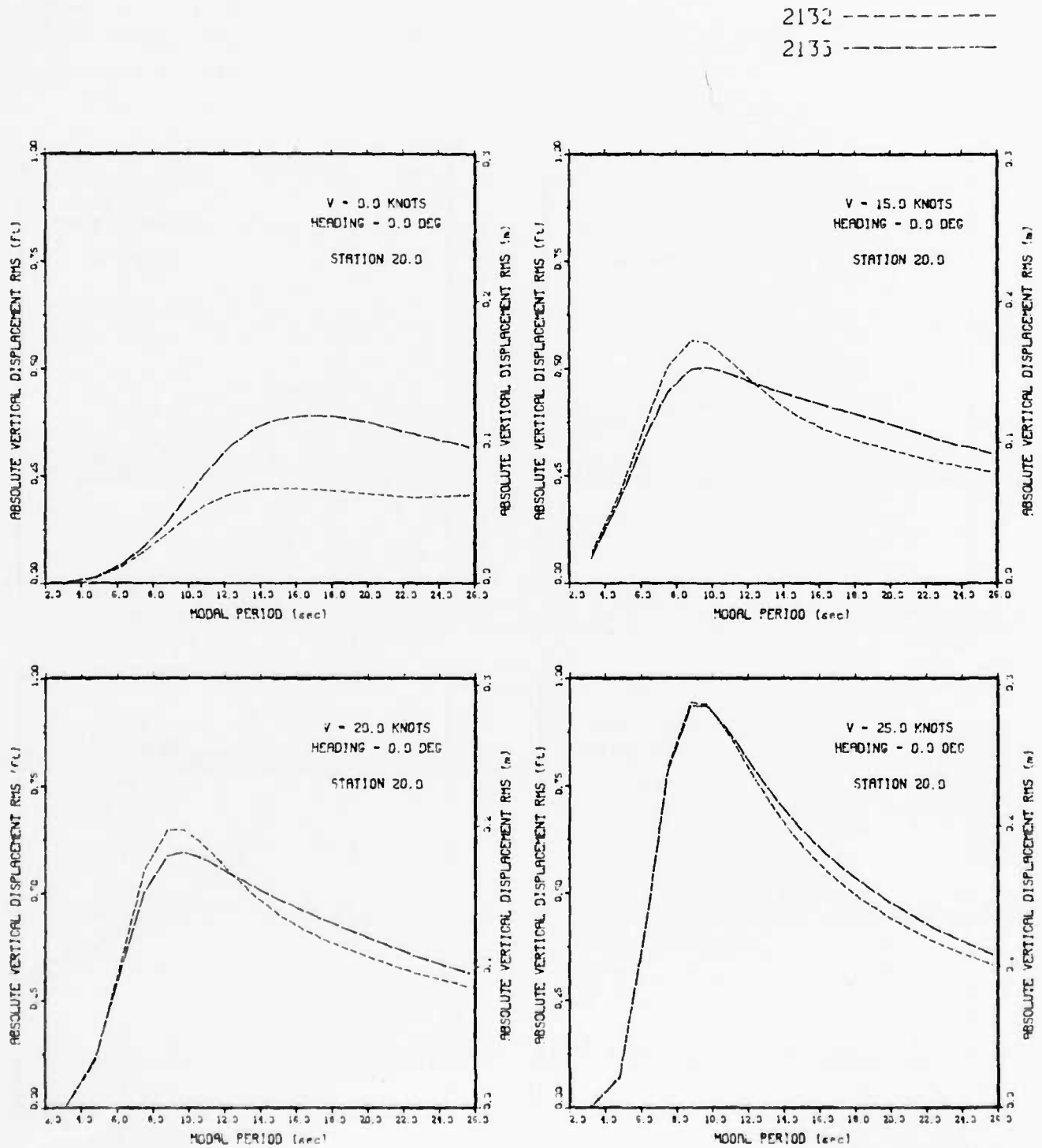


Figure 91 - Responses for Configurations 2132 and 2133

FIGURE 9 - CONTINUED

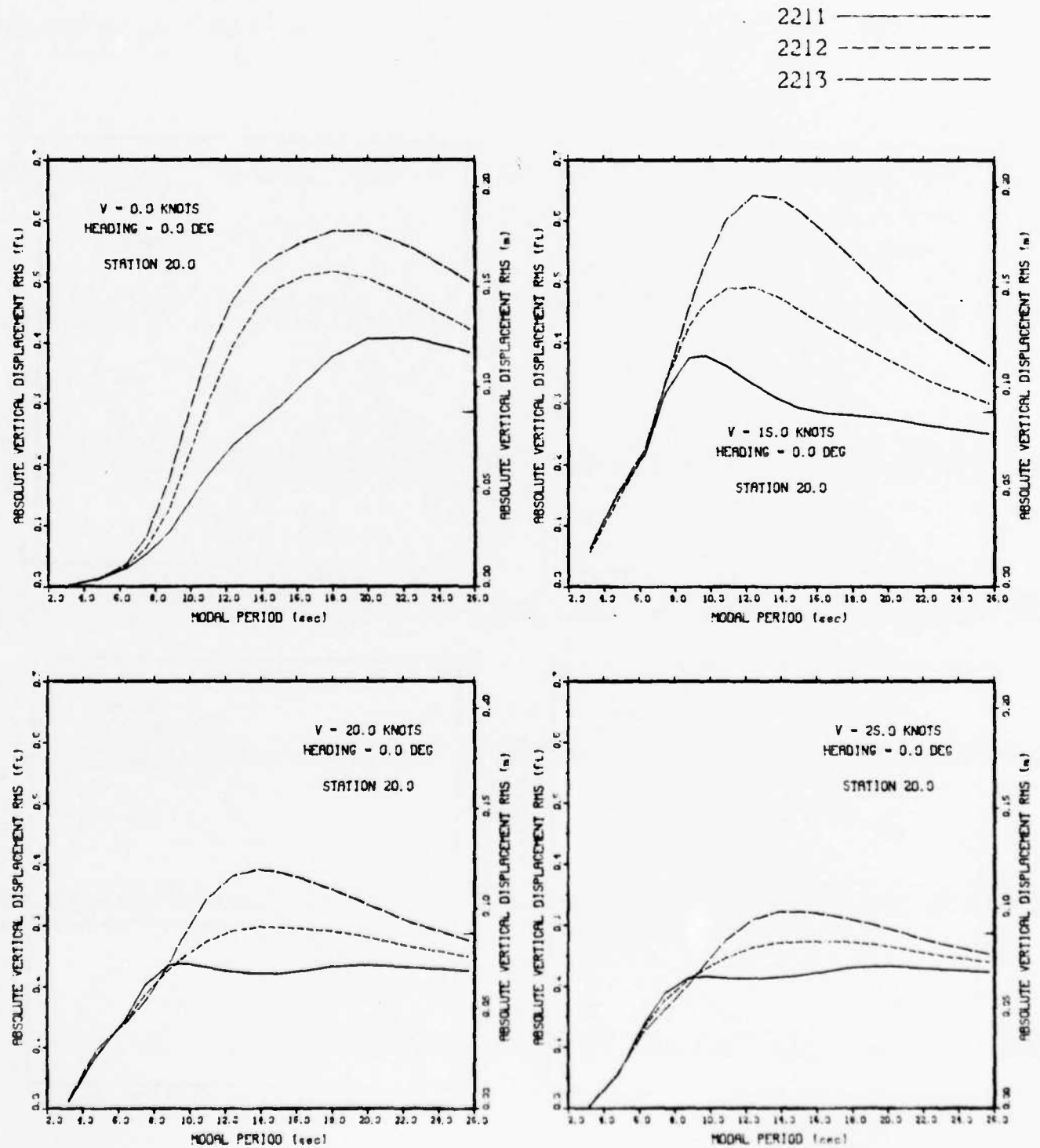


Figure 9m - Responses for Configurations 2211, 2212, and 2213

FIGURE 9 - CONTINUED

2221 —————
 2222 - - - - -
 2223 — · — · —

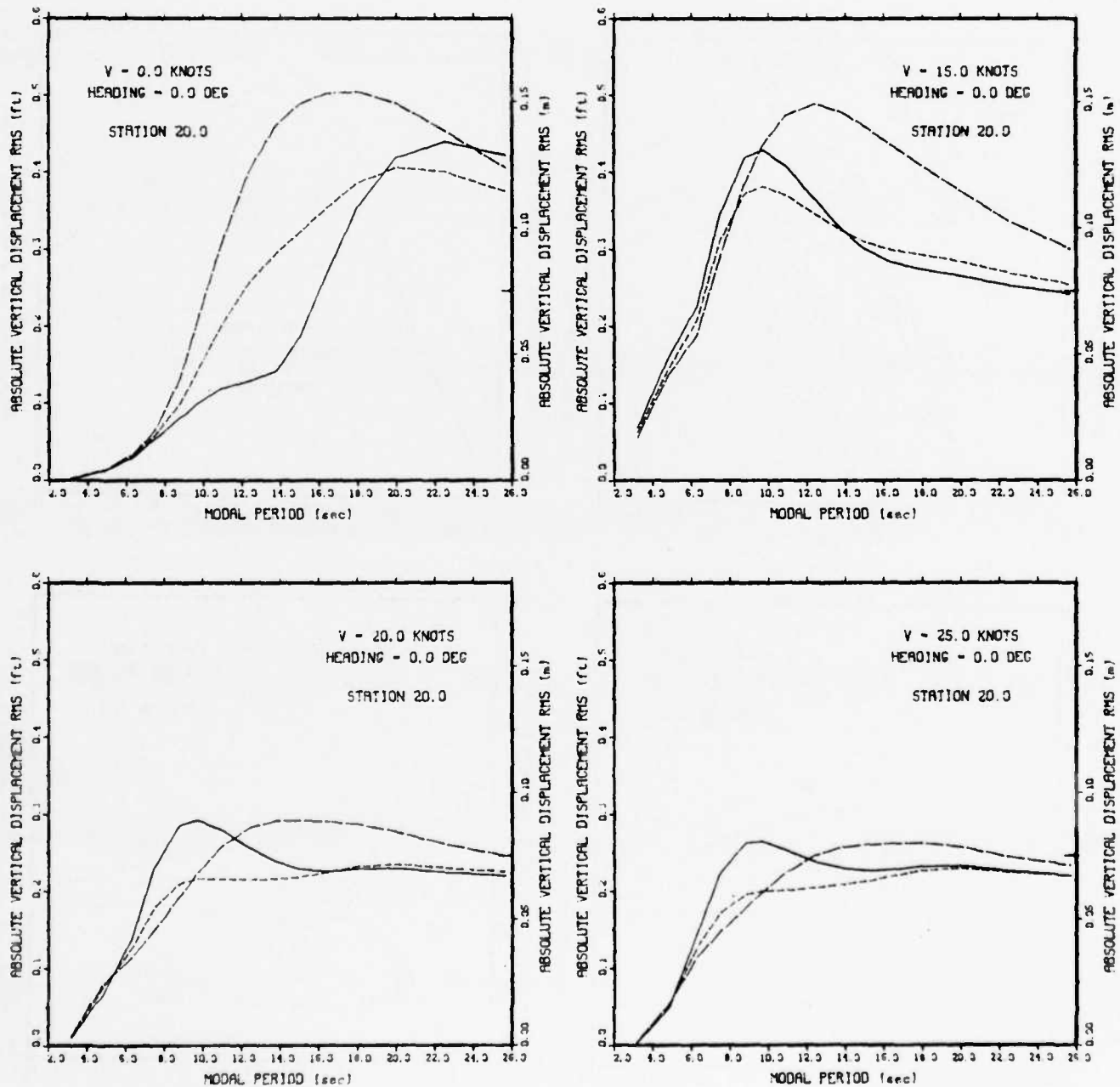


Figure 9n - Responses for Configurations 2221, 2222, and 2223

FIGURE 9 - CONTINUED

2231 —————
 2232 - - - - -
 2233 - - - - -

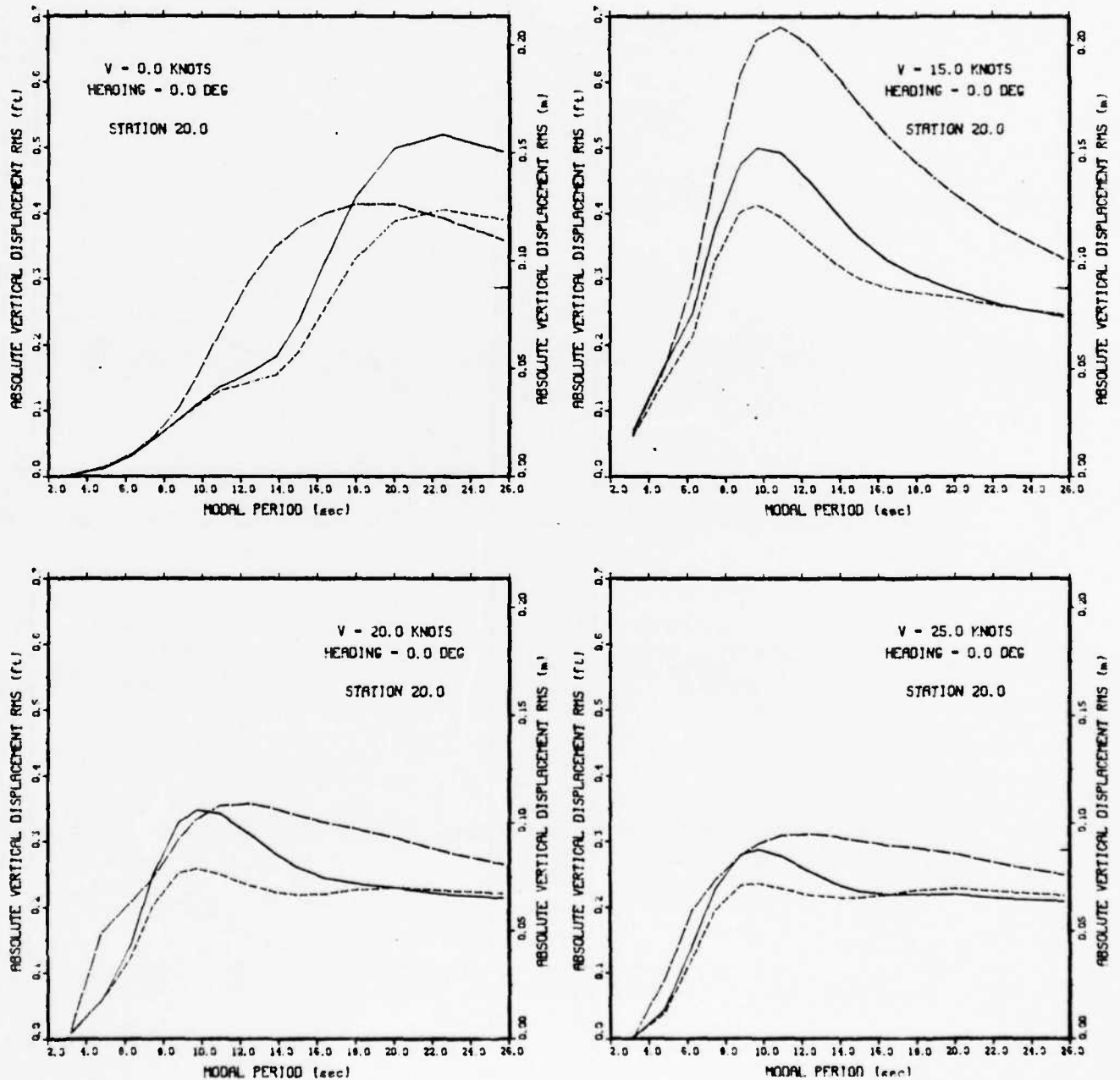


Figure 9a - Responses for Configurations 2231, 2232, and 2233

FIGURE 9 - CONTINUED

2311 —————
 2312 - - - - -
 2313 - - - - -

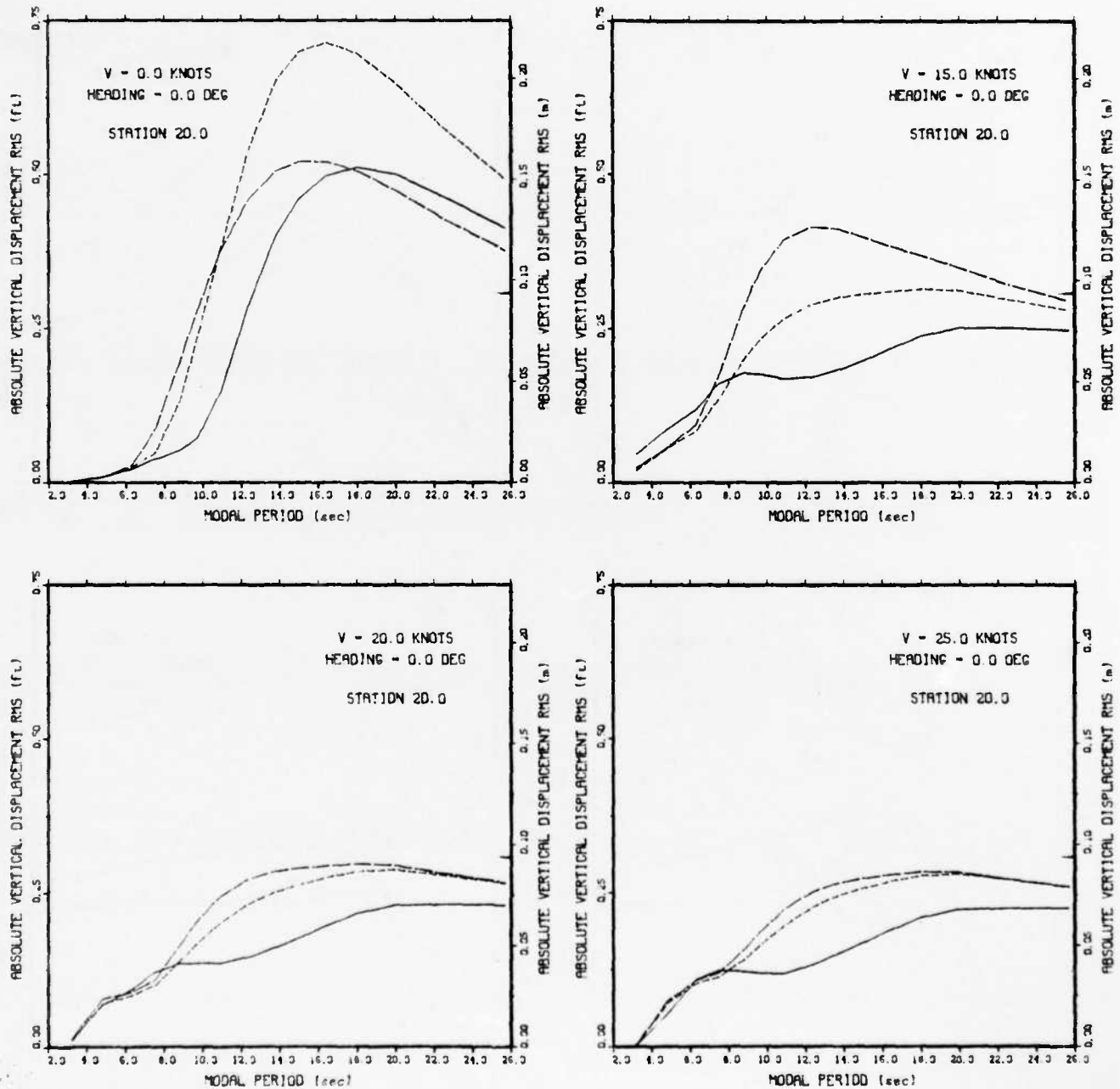


Figure 9p - Responses for Configurations 2311, 2312, and 2313

FIGURE 9 - CONTINUED

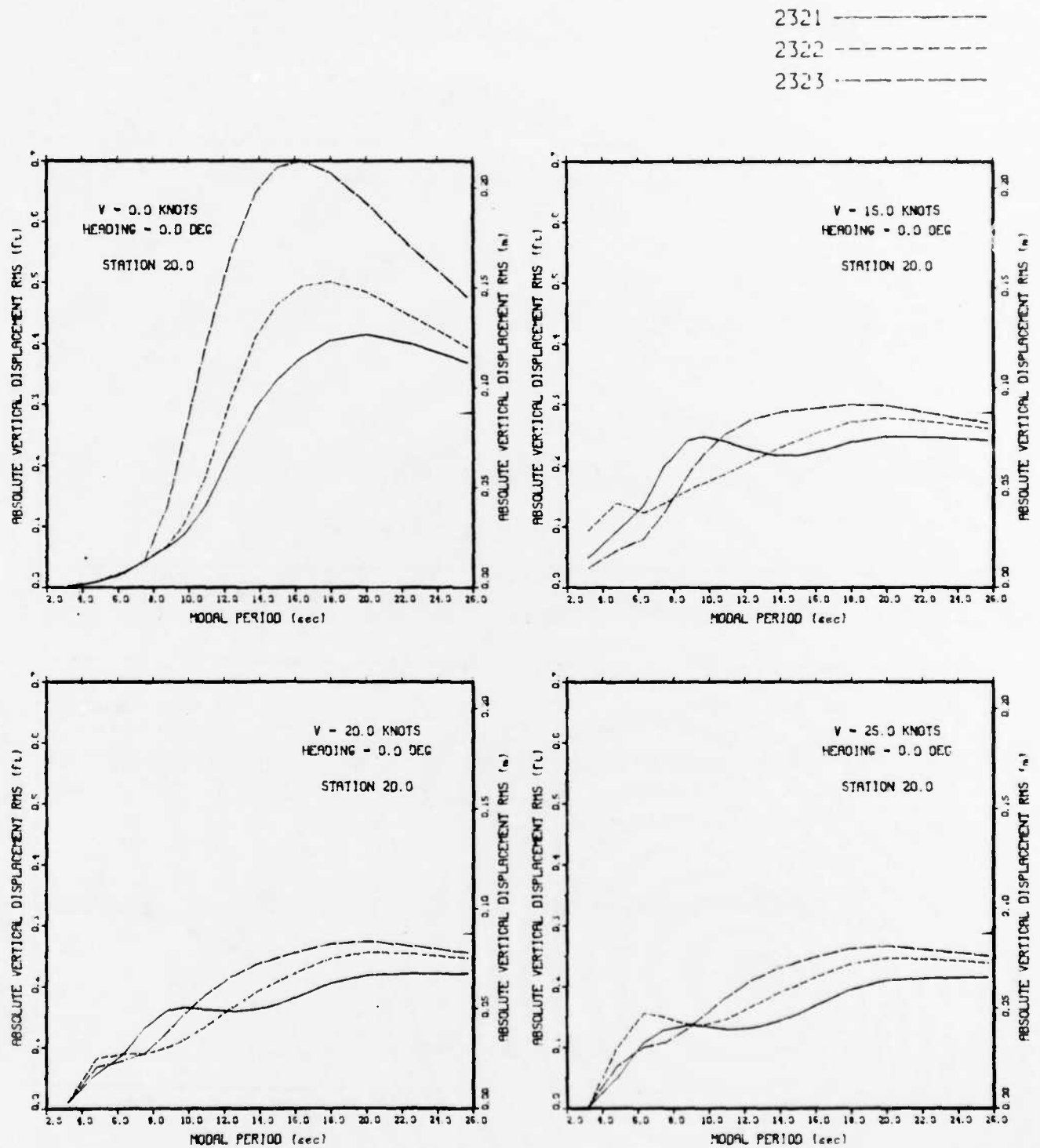


Figure 9q - Responses for Configurations 2321, 2322, and 2323

FIGURE 9 - CONTINUED

2331 ———
2332 - - -
2333 - - -

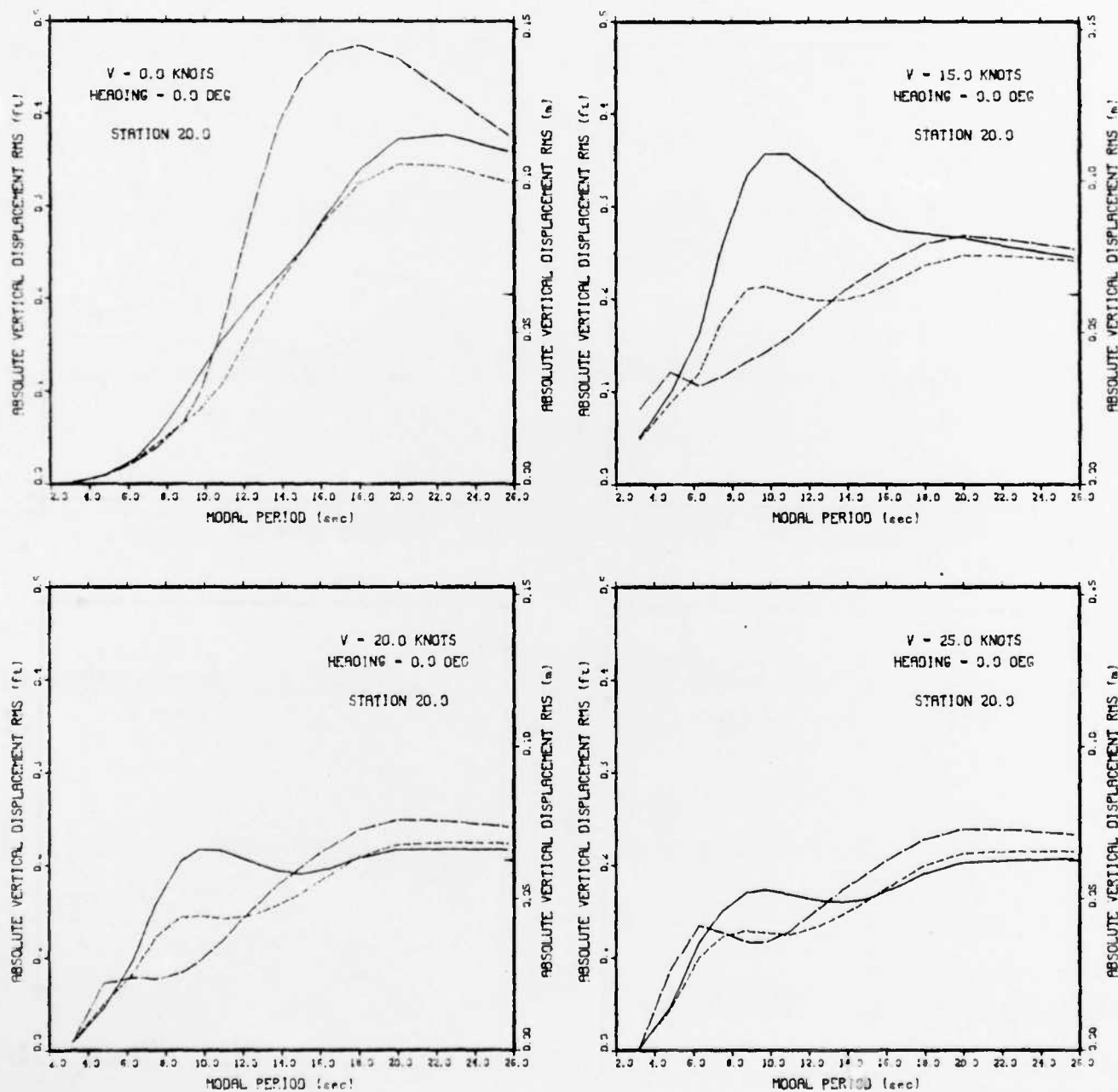


Figure 9r - Responses for Configurations 2331, 2332, and 2333

FIGURE 9 - CONTINUED

3111 —————
 3112 - - - - -
 3113 - - - - -

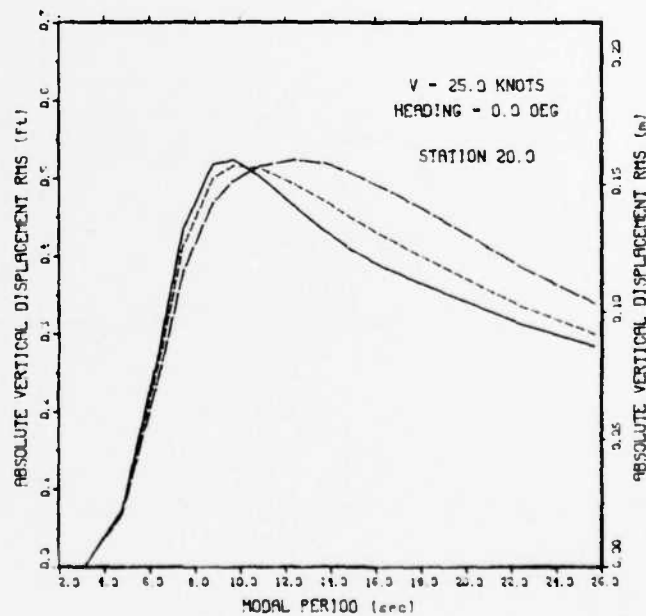
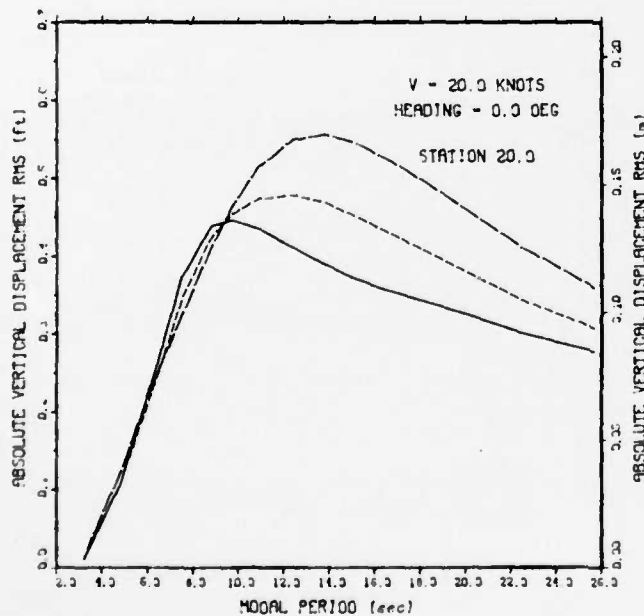
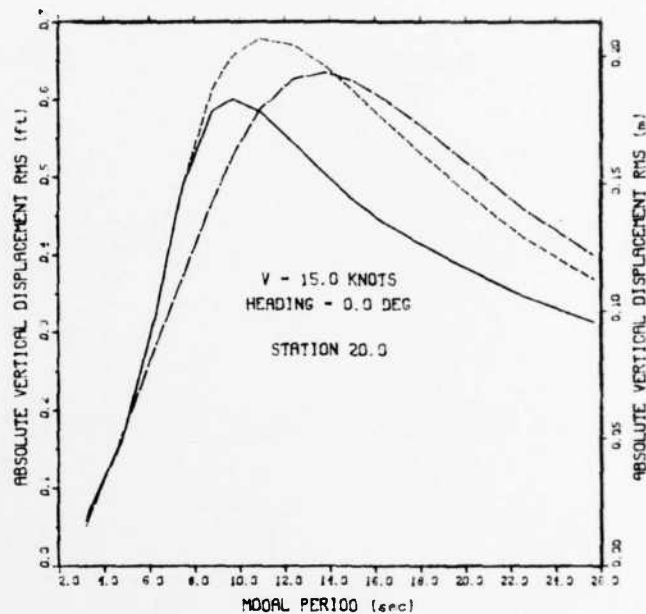
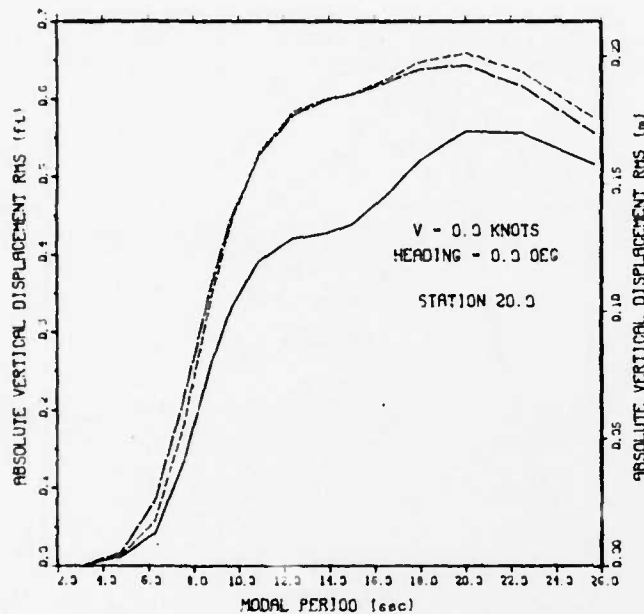


Figure 9s - Responses for Configurations 3111, 3112, and 3113

FIGURE 9 - CONTINUED

3121 —————
 3122 - - - - -
 3123 - - - - -

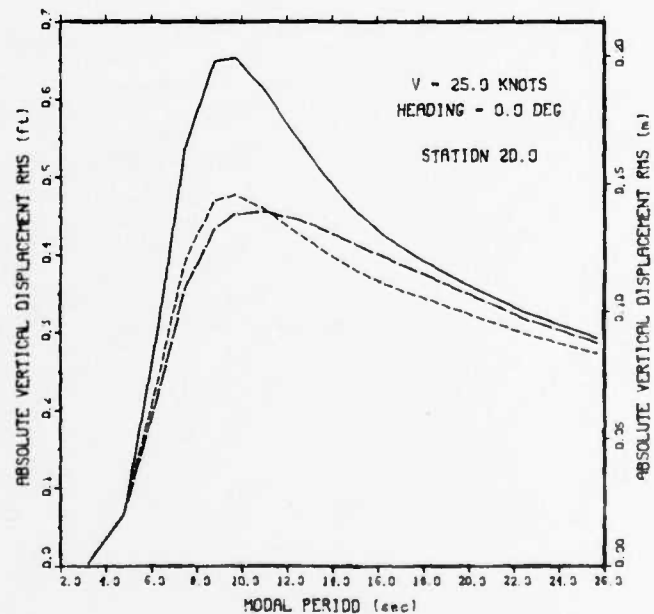
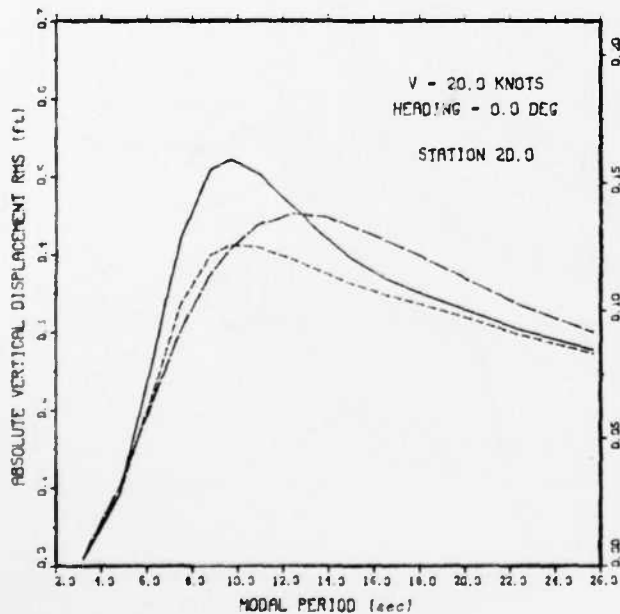
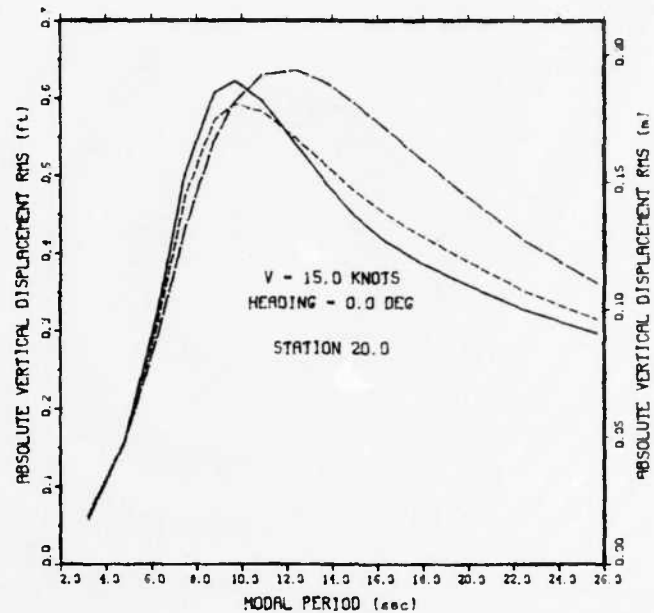
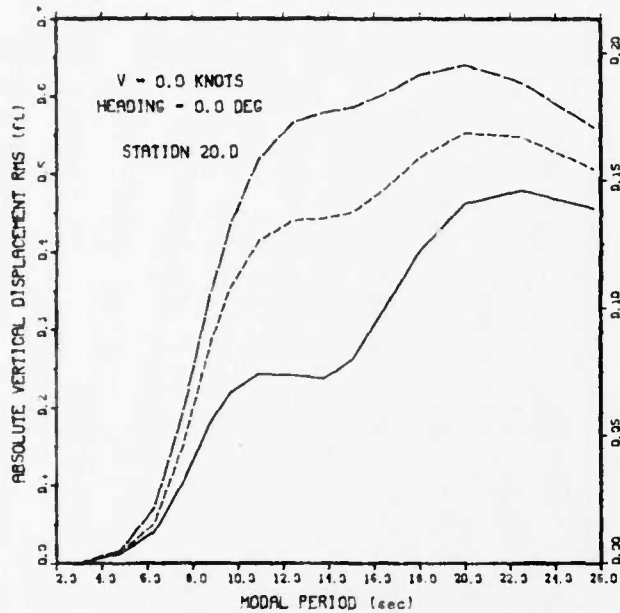


Figure 9t - Responses for Configurations 3121, 3122, and 3123

FIGURE 9 - CONTINUED

3132 -----
3133 -----

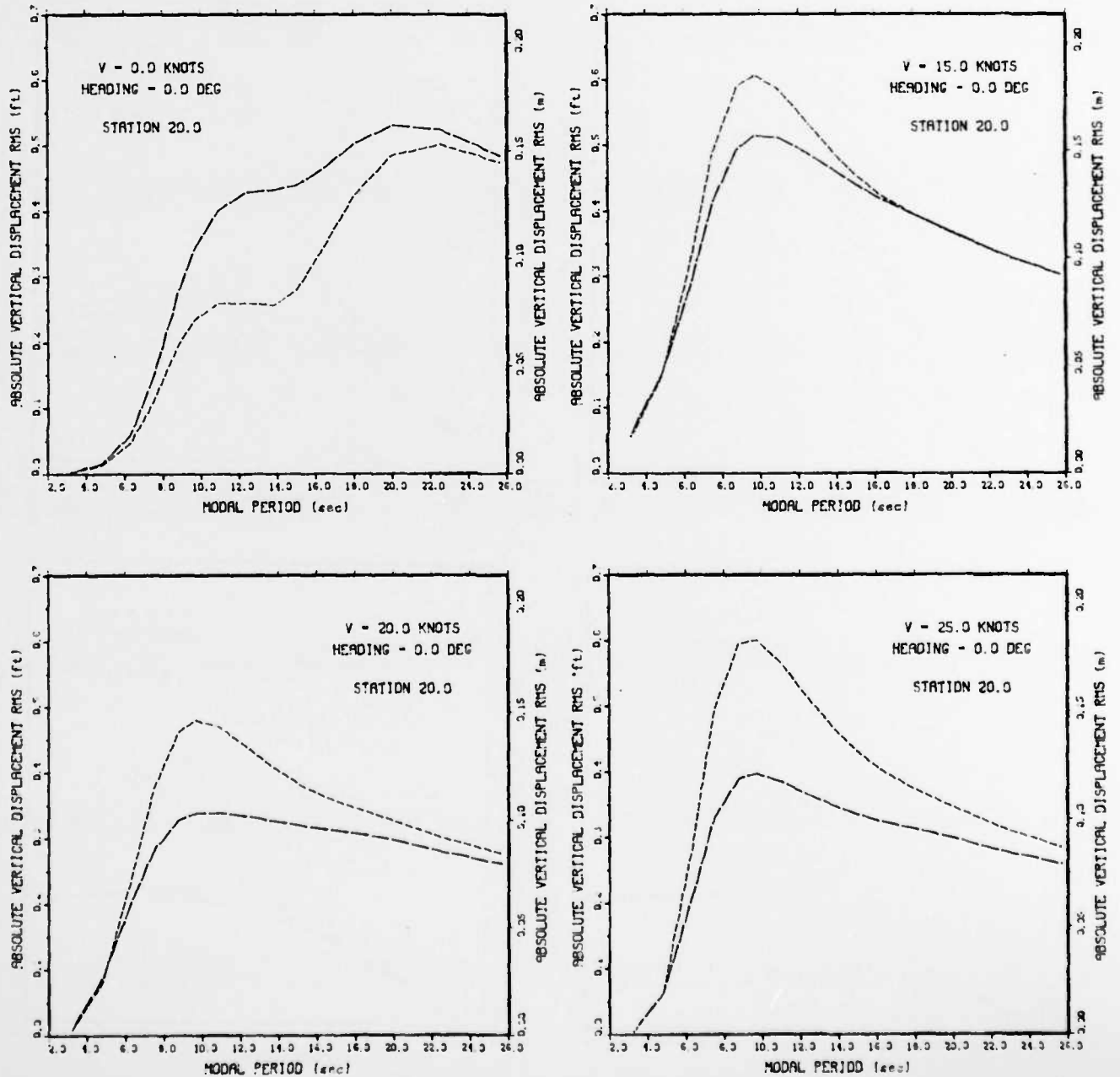


Figure 9u - Responses for Configurations 3132 and 3133

FIGURE 9 - CONTINUED

3211 —————
 3212 - - - - -
 3213 - - - - -

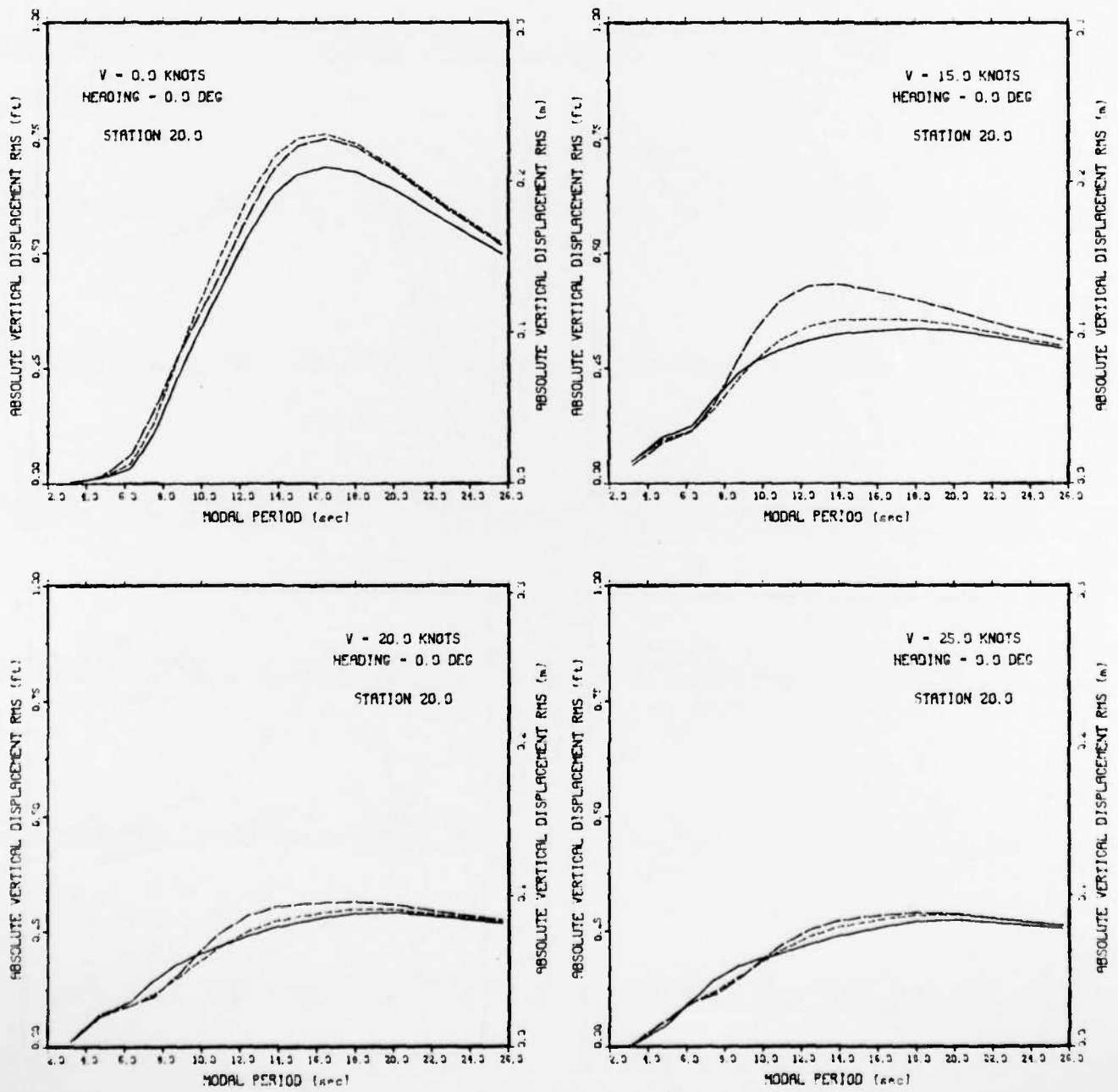


Figure 9v - Responses for Configurations 3211, 3212, and 3213

FIGURE 9 - CONTINUED

3221 —————
 3222 - - - - -
 3223 — · — · —

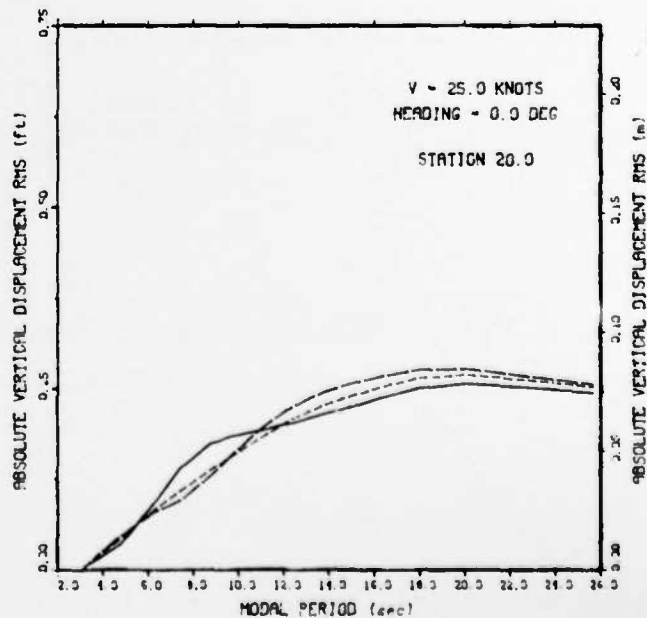
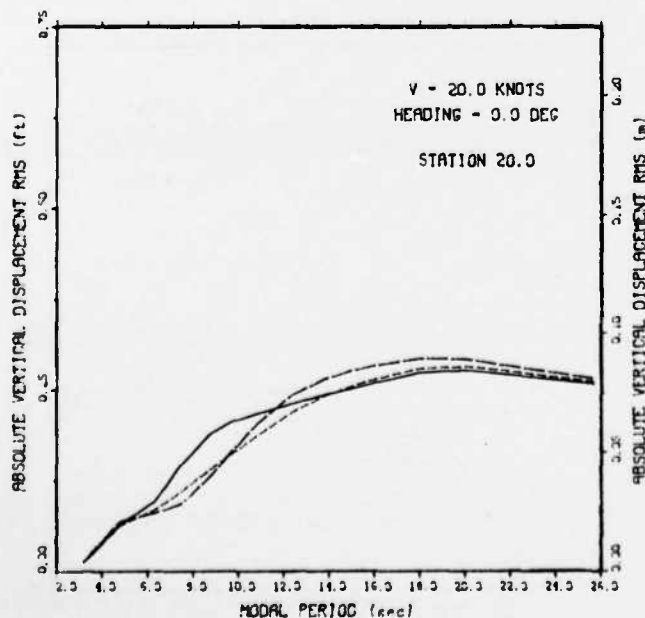
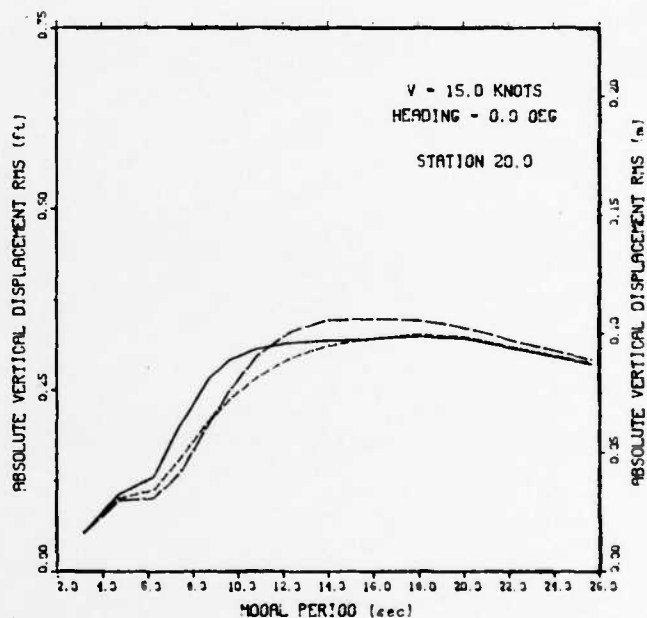
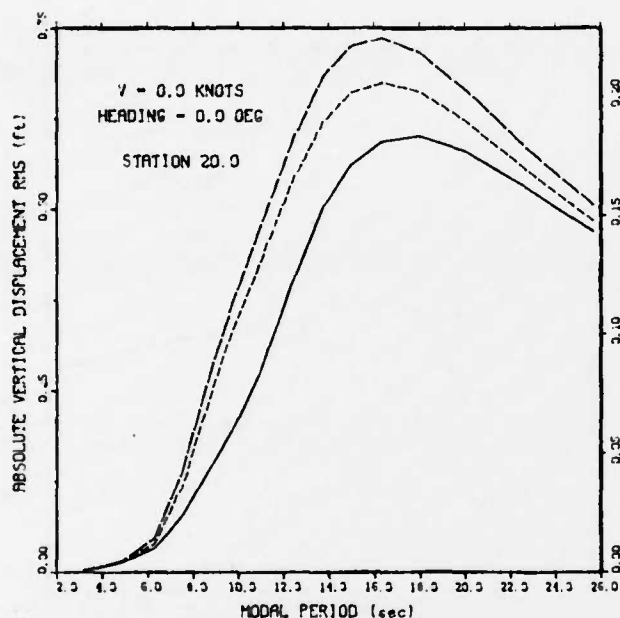


Figure 9w - Responses for Configurations 3221, 3222, and 3223

FIGURE 9 - CONTINUED

3231 —————
 3232 - - - - -
 3233 - - - - -

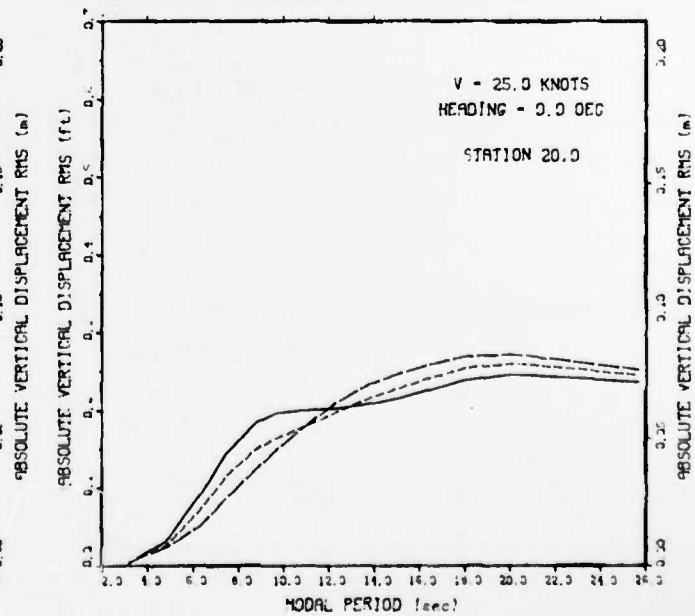
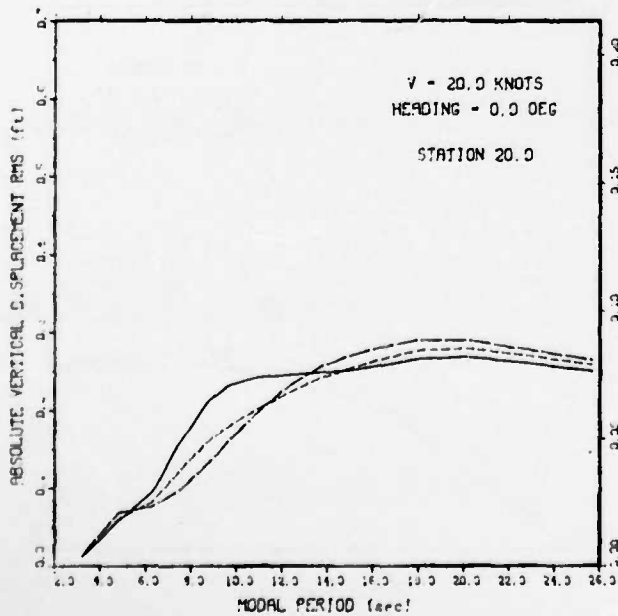
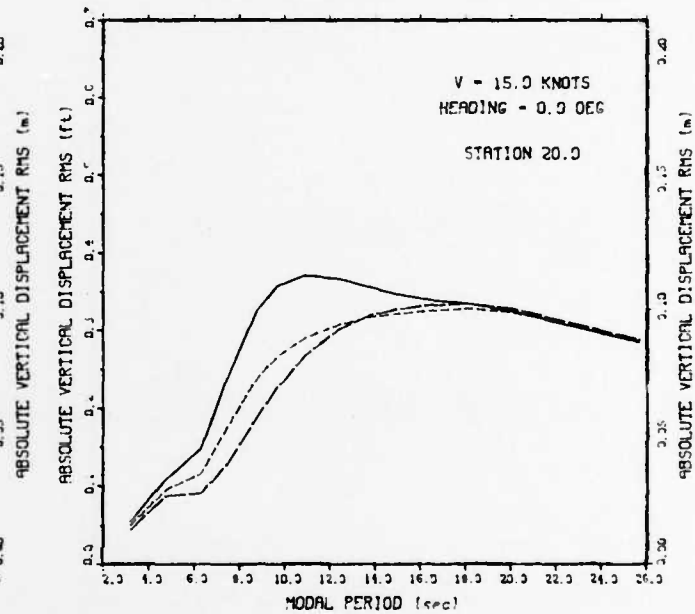
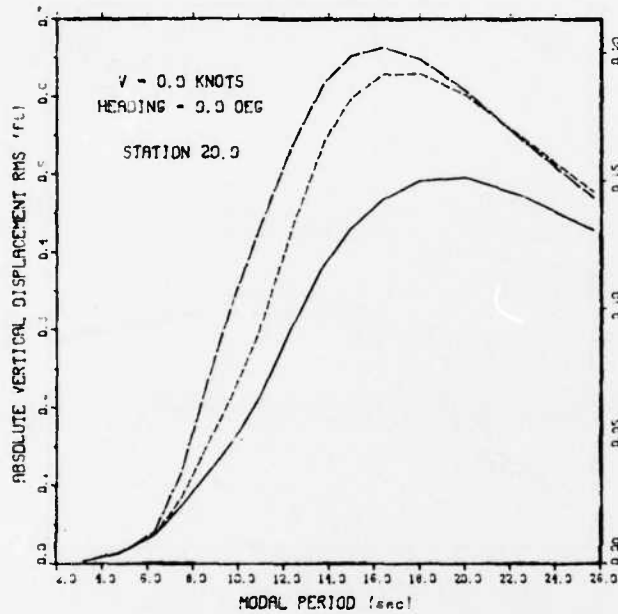


Figure 9x - Responses for Configurations 3231, 3232, and 3233

FIGURE 9 - CONTINUED

3311 —————
 3312 - - - - -
 3313 - - - - -

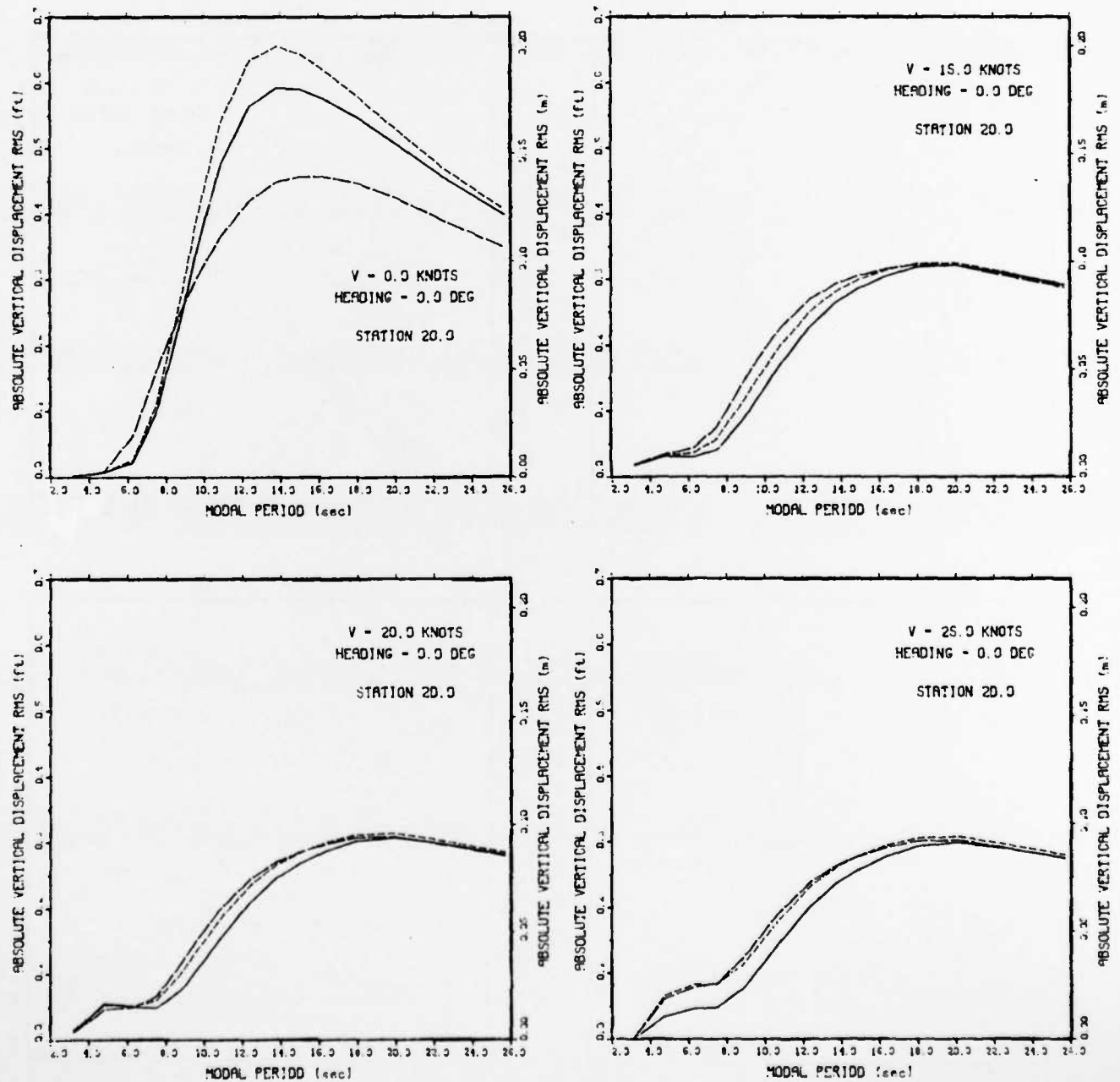


Figure 9y - Responses for Configurations 3311, 3312, and 3313

FIGURE 9 - CONTINUED

3321 —————
 3322 - - - - -
 3323 ————

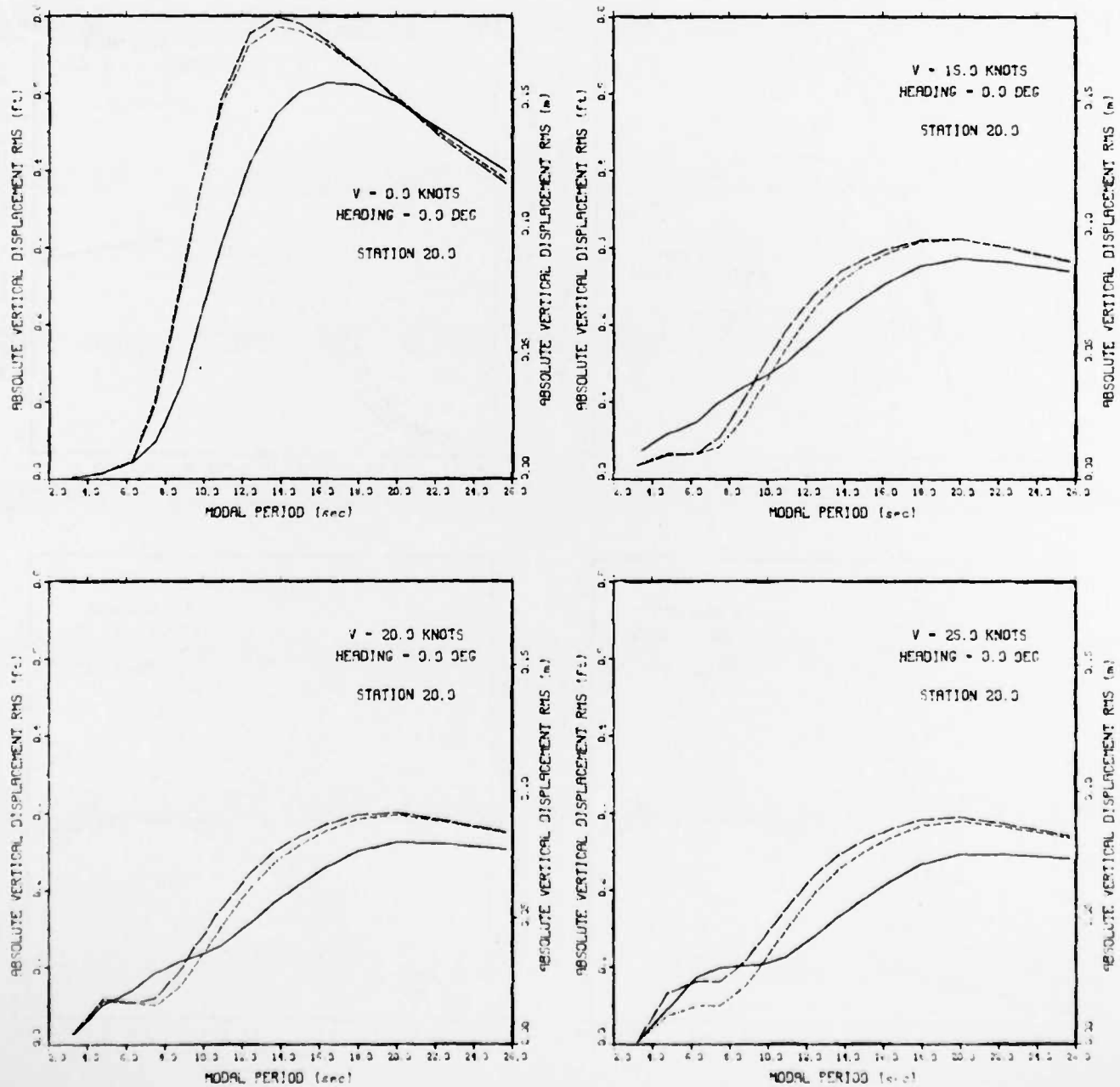


Figure 9z - Responses for Configurations 3321, 3322, and 3323

FIGURE 9 - CONTINUED

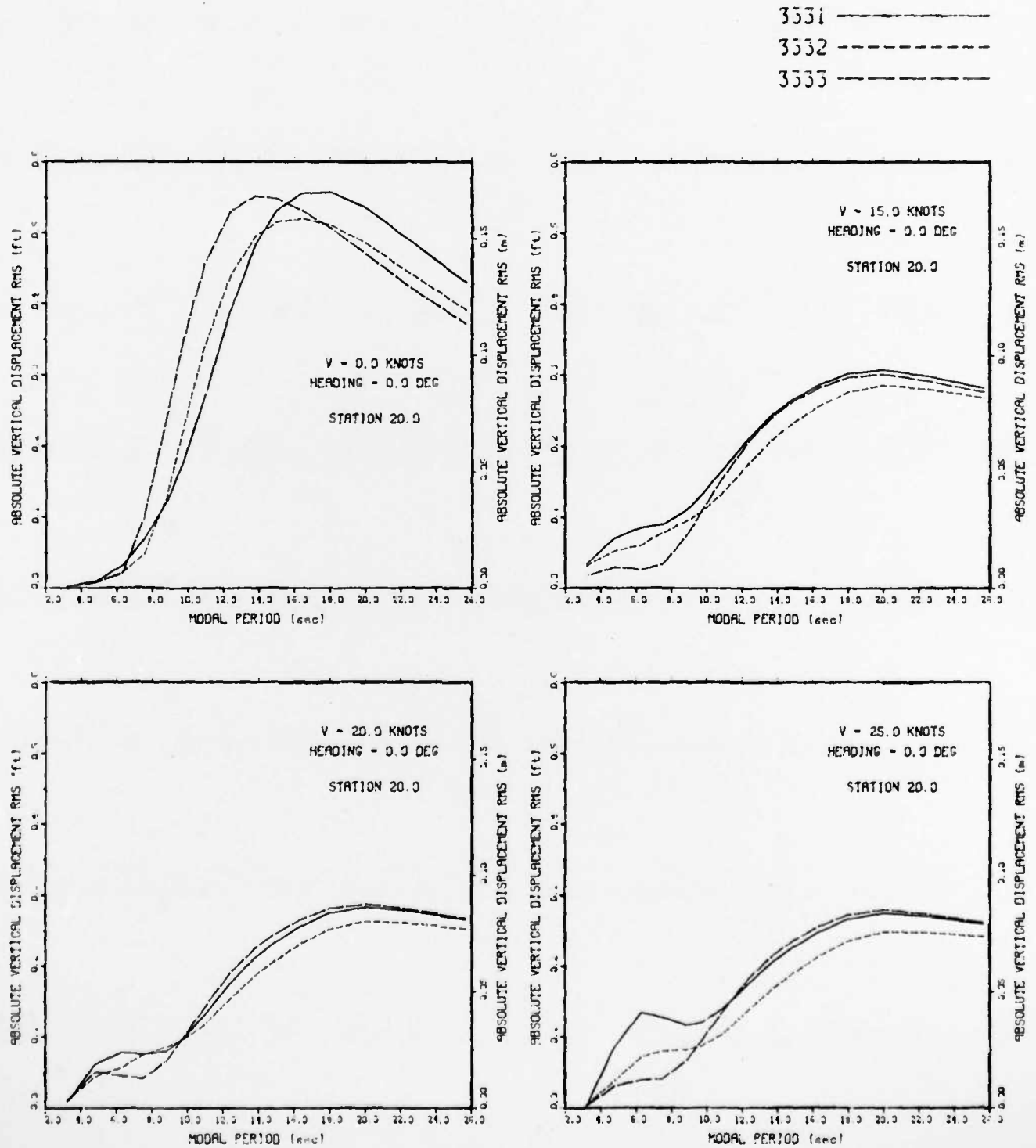


Figure 9aa - Responses for Configurations 3331, 3332, and 3333

DTNSRDC ISSUES THREE TYPES OF REPORTS

1. DTNSRDC REPORTS, A FORMAL SERIES, CONTAIN INFORMATION OF PERMANENT TECHNICAL VALUE. THEY CARRY A CONSECUTIVE NUMERICAL IDENTIFICATION REGARDLESS OF THEIR CLASSIFICATION OR THE ORIGINATING DEPARTMENT.

2. DEPARTMENTAL REPORTS, A SEMIFORMAL SERIES, CONTAIN INFORMATION OF A PRELIMINARY, TEMPORARY, OR PROPRIETARY NATURE OR OF LIMITED INTEREST OR SIGNIFICANCE. THEY CARRY A DEPARTMENTAL ALPHANUMERICAL IDENTIFICATION.

3. TECHNICAL MEMORANDA, AN INFORMAL SERIES, CONTAIN TECHNICAL DOCUMENTATION OF LIMITED USE AND INTEREST. THEY ARE PRIMARILY WORKING PAPERS INTENDED FOR INTERNAL USE. THEY CARRY AN IDENTIFYING NUMBER WHICH INDICATES THEIR TYPE AND THE NUMERICAL CODE OF THE ORIGINATING DEPARTMENT. ANY DISTRIBUTION OUTSIDE DTNSRDC MUST BE APPROVED BY THE HEAD OF THE ORIGINATING DEPARTMENT ON A CASE-BY-CASE BASIS.

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- 3. TECHNICAL MEMORANDA, AN INFORMAL SERIES, CONTAIN TECHNICAL DOCUMENTATION OF LIMITED USE AND INTEREST. THEY ARE PRIMARILY WORKING PAPERS INTENDED FOR INTERNAL USE. THEY CARRY AN IDENTIFYING NUMBER WHICH INDICATES THEIR TYPE AND THE NUMERICAL CODE OF THE ORIGINATING DEPARTMENT. ANY DISTRIBUTION OUTSIDE DTNSRDC MUST BE APPROVED BY THE HEAD OF THE ORIGINATING DEPARTMENT ON A CASE-BY-CASE BASIS.**

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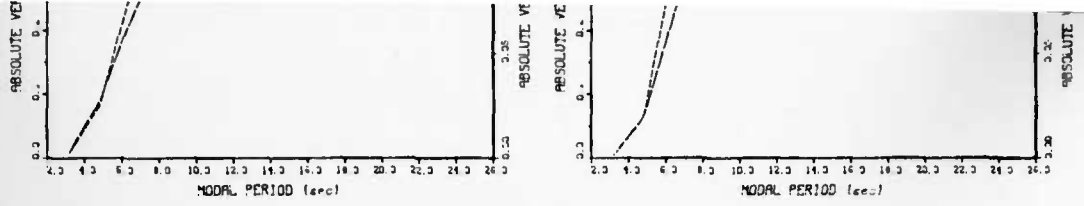


Figure 9u - Responses for Configurations 3132 and 3133

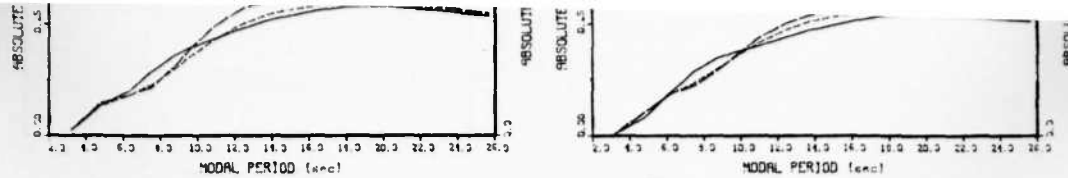


Figure 9v - Responses for Configurations 3211, 3212, and 3213

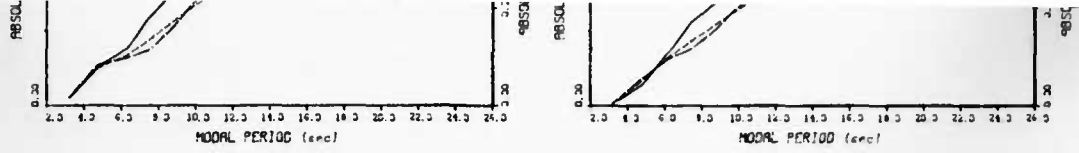


Figure 9w - Responses for Configurations 3221, 3222, and 3223

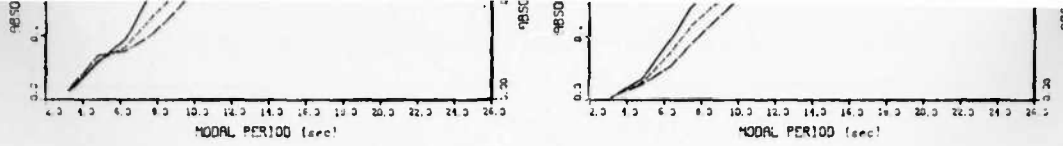


Figure 9x - Responses for Configurations 3231,3232, and 3233

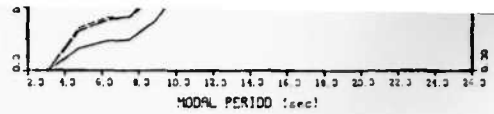
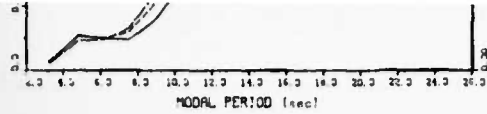


Figure 9y - Responses for Configurations 3311, 3312, and 3313

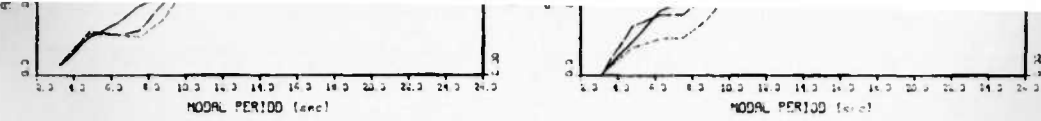


Figure 9z - Responses for Configurations 3321, 3322, and 3323

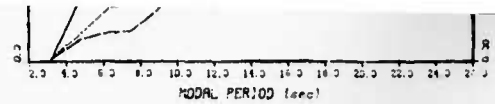
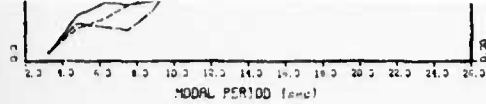


Figure 9aa - Responses for Configurations 3331, 3332, and 3333

